THE

Tea Research Institute

OF

Ceylon

BULLETIN No. 38

Annual Report for the Year 1956

Published by
THE TEA RESEARCH INSTITUTE OF CEYLON
ST. COOMBS, TALAWAKELLE, CEYLON.
1957.

COMMONWEALTH MYCOLOGICAL INSTITUTE
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The Tea Research Institute of Ceylon

Staff at December, 31st 1956

Director	...	G. B. Portsmouth, B.Sc. (Hons.) (Lond.), A.R.C.S., D.I.C.
Technical Assistant to the Director	...	J. V. Harbord, M.A. (Cantab.), A.I.C.T.A.
Chemistry		
Agricultural Chemist	...	J. A. H. Tolhurst, B.Sc. (Hons. Agric. Chem.) (Reading)
Research Assistant, Biochemistry	...	M. S. Ramaswamy, B.Sc. (Hons.) (Mysore), A.R.I.C., A.I.I.Sc.
Research Assistant to the Agricultural Chemist	...	E. N. Perera
Assistant	...	V. Mendis
Technology		
Technologist	...	E. L. Keegel, (on study leave)
Assistant	...	S. M. Gunaratnam
Plant Physiology		
Plant Physiologist	...	T. Visser, Dr., Ir. (L. I. Wageningen).
Vegetative Propagation Officer	...	F. H. Kehl
Assistants	...	M. Piyasena, L. M. de W. Tillekeratne, B.Sc. (Cey.), A. C. B. Pethiyagoda, D. H. de Saram, D. D. Kroon, H. B. Ratnayake, J. I. H. Bandaranayake and J. A. Gunasekera
Pathology		
Pathologist	...	B. N. Webster, M.A. (Cantab.), M.Sc. (Nottm.), M.I.Biol.
Assistants	...	M. K. Vythilingam, J. V. Sabanayagam and S. Murugiah.
Entomology		
Entomologist	...	G. D. Austin
Entomologist, Special Research	...	E. Judenko, Ph.D. (Cracow)
Assistants	...	D. J. W. Ranaweera, C. Shanmugan, and G. B. Rajapakse.
Engineering		
Maintenance Engineer	...	D. V. W. Perera
Works Clerk	...	R. A. Daniel
Electrician	...	W. R. Solomon
Mechanics	...	D. A. S. Opatha and K. S. Vadivelu
St. Coombs Estate		
Superintendent	...	E. S. Rose
Tea Maker	...	A. T. Fernando
Apothecary	...	S. P. de Silva
Office Assistants	...	P. E. de Silva and G. L. A. Thomas
Low-Country		
Scientific Adviser	...	A. W. R. Joachim, O.B.E., B.Sc. (Hons.) (Lond.) Ph.D., F.R.I.C., Dip. Agric. (Cantab.)
Assistant	...	F. P. Jayawardene
Administration		
Secretary	...	G. A. D. Kehl
Secretary to Director	...	A. C. Perera
Assistant Secretary	...	C. Kirthiratne, A.C.C.S. (Lond.), F.R.Econ.S.
Accounts Clerk	...	A. H. B. Dias
Office Assistants	...	F. G. de Sielvie, D. C. W. T. Amarasingha, F. N. C. de Silva, R. I. Pereira and W. P. Chandrasekera.

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THIRTY-FIRST ANNUAL REPORT OF THE BOARD OF THE TEA RESEARCH INSTITUTE OF CEYLON FOR THE YEAR 1956

Foundation.—The Tea Research Institute of Ceylon was established by Ordinance No. 12 of 1925 dated 27th October, 1925.

The personnel constituting the Board of Control is laid down in the above Ordinance and in the following Tea Research (Amendment) Acts:—

No. 24 of 1948 dated 20th December, 1948
No. 51 of 1953 ,, 19th ,, 1953
No. 20 of 1955 ,, 14th April 1955

The members of the Board on 1st January, 1956, were:—

Ex-Officio Members

The Director of Agriculture (Dr. A. W. R. Joachim, O.B.E., on leave; Dr. W. R. C. Paul acting).

The Hon'ble the Minister of Finance (represented by Mr. R. H. Wickramasinghe, M.B.E., Acting Deputy Secretary to the Treasury).

The Chairman, Planters' Association of Ceylon (Mr. K. G. Sinclair).

The Chairman, Agency Section, Planters' Association of Ceylon (Mr. A. D. McLeod).

The Tea Controller (Mr. D. C. L. Amarasinghe, C.C.S.).

Representatives of the Planters' Association of Ceylon

Mr. R. C. Scott, C.B.E.
Mr. N. B. Parker
Vacant.

Representatives of the Planters' Association of Ceylon, Agency Section.

Mr. R. M. Macintyre.
Mr. G. K. Newton.
Mr. G. J. Harris.

Representatives of the Low-country Products Association.

Mr. J. L. D. Peiris.
Mr. B. Amarasuriya.
Mr. F. Amarasuriya.

Representatives of the Smallholders.

Mr. V. G. W. Ratnayaka, M.B.E., M.P.
Mr. A. Divitotawela.

Representative of the House of Representatives.

Mr. U. B. Unamboowe, O.B.E., M.P.

Chairman: Mr. K. G. Sinclair.
Secretary: Mr. G. B. Portsmouth.
Solicitors: Messrs. Julius & Creasy.
Auditors: Messrs. Ford, Rhodes, Thornton & Co.
Registered Office: St. Coombs, Talawakelle.

The following changes in the personnel of the Board were recorded during the year:—

Ex-Officio Members.—Dr. A. W. R. Joachim, O.B.E., returned to the island in January and resumed his seat vice Dr. W. R. C. Paul (acting).

Senator T. Amarasuriya, O.B.E., Chairman, Planters' Association of Ceylon, vice Mr. K. G. Sinclair as from 23rd March.

Mr. R. M. Macintrye, Chairman, Planters' Association of Ceylon, Agency Section, vice Mr. A. D. McLeod as from 1st June.

Mr. B. Mahadeva, C.C.S., Acting Tea Controller, acted for Mr. D. C. L. Amarasinghe, C.C.S., as from 20th July.

Dr. A. W. R. Joachim, O.B.E., retired as Director of Agriculture on 18th August, and was succeeded on the Board by Dr. W. R. C. Paul, Acting Director of Agriculture, as from that date.

Representatives of the Planters' Association of Ceylon.—Mr. W. H. W. Coultas was nominated to the vacant seat as from 14th February.

Representatives of the Planters' Association of Ceylon, Agency Section.—Mr. A. D. McLeod vice Mr. R. M. Macintyre as from 1st June.

Mr. W. H. Gourlay acted for Mr. A. D. McLeod (on leave) from 1st June until 3rd November.

Mr. M. B. Butler-Cole acted for Mr. G. J. Harris (on leave) from 2nd June until 6th December.

Representative of the House of Representatives.—Mr. U. B. Unamboowe, O.B.E., ceased to be a member of the Board as from 18th February, the date of the dissolution of Parliament. Mr. S. Jinadasa, M.P., was nominated to fill the vacant seat as from 30th May.

The Chairman.—Mr. F. Amarasuriya was unanimously elected Chairman in succession to Mr. Sinclair at a special meeting called on 28th March. The Board paid tribute to Mr. Sinclair's services as Chairman during his brief period of office, and wished him a happy retirement.

Six meetings of the Board were held during the year, on 2nd March, 28th March, 1st June, 7th September, 2nd November and 7th December.

Committees.—*Finance Committee.*—The Chairman, T.R.I. and Chairman, Planters' Association of Ceylon (Mr. K. G. Sinclair), the Chairman, Planters' Association of Ceylon, Agency Section (Mr. A. D. McLeod), Mr. J. L. D. Peiris, Mr. R. H. Wickramasinghe, M.B.E., Mr. R. M. Macintyre, Mr. G. B. Portsmouth (Secretary).

The following changes took place during the year:—

Senator T. Amarasuriya, O.B.E., (Chairman, Planters' Association of Ceylon) vice Mr. K. G. Sinclair as from 23rd March.

Mr. F. Amarasuriya (Chairman, T.R.I.) vice Mr. K. G. Sinclair as from 28th March.

Mr. R. M. Macintyre (Chairman, Planters' Association of Ceylon, Agency Section) vice Mr. A. D. McLeod as from 1st June.

Mr. W. H. Gourlay vice Mr. R. M. Macintyre as from 7th September.

Mr. A. D. McLeod vice Mr. W. H. Gourlay as from 3rd November.

Two meetings were held during the year, on 6th September and 6th December.

Standing Committee.—Mr. K. G. Sinclair (Chairman), Mr. D. C. L. Amarasinghe, C.C.S., Mr. A. D. McLeod, Mr. F. Amarasuriya, Mr. G. B. Portsmouth (Secretary).

The following changes occurred during the year:—

Senator E. W. Kannangara, C.B.E., was nominated to take Mr. Sinclair's ordinary seat vacated by him, following his election to the Chairmanship of the Board, as from 2nd March.

Mr. F. Amarasuriya became Chairman of the Committee vice Mr. K. G. Sinclair as from 28th March.

Mr. F. Amarasuriya's ordinary seat was filled by Mr. R. M. Macintyre as from 1st June.

Mr. W. H. Gourlay acted for Mr. A. D. McLeod (on leave) from 1st June to 3rd November.

Mr. B. Mahadeva, C.C.S., acted for Mr. D. C. L. Amarasinghe, C.C.S. as from 20th July.

Five meetings were held, on 4th February, 11th May, 20th July, 10th August and 2nd November.

Experimental and Estate Committee.—Chairman, the Director, T.R.I. (Mr. G. B. Portsmouth), Mr. K. G. Sinclair (Chairman, T.R.I., and Chairman, Planters' Association of Ceylon), Mr. G. K. Newton (Visiting Agent, St. Coombs Estate), Mr. E. S. Rose (Superintendent, St. Coombs Estate), Mr. R. C. Scott, C.B.E., Mr. D. E. Hettiarachchi, Mr. S. P. Vytilingam, Mr. A. Watt, Mr. R. C. P. Adams, Mr. R. L. Harvey, Mr. K. Morford, C.B.E., Mr. R. J. S. Bean, Mr. A. J. Pelly-Fry (Acting for Mr. T. Kane), Mr. Gorton Coombe (Acting for Mr. J. E. Davidson) and the Senior Staff, T.R.I., with Mr. J. V. Harbord as Convener.

The following changes took place during the year:—

Mr. J. E. Davidson resumed his seat vice Mr. Gorton Coombe (Acting) as from 1st March.

Mr. T. Amarasuriya, O.B.E. (Chairman, Planters' Association of Ceylon) vice Mr. K. G. Sinclair as from 23rd March.

Mr. F. Amarasuriya (Chairman, T.R.I.) vice Mr. K. G. Sinclair as from 28th March.

Mr. T. Kane resumed his seat vice Mr. A. J. Pelly-Fry (Acting) as from 1st June.

Mr. B. D. Fay acted for Mr. R. L. Harvey (on leave) as from 2nd November.

The Committee met four times, on 18th February, 12th Mar, 11th August and 10th November.

Low-country Committee.—Mr. F. Amarasuriya, Mr. J. L. D. Peiris, Mr. R. J. S. Bean (co-opted), Mr. G. B. Portsmouth (Director, T.R.I.).

There were no changes in the membership, and no meetings during the year.

Smallholdings Committee.—Mr. V. G. W. Ratnayaka, M.B.E. (Chairman), Mr. D. C. L. Amarasinghe, C.C.S., Mr. F. Amarasuriya, Mr. A. Divitotawela, Mr. G. B. Portsmouth (Director, T.R.I.), Mr. R. L. Illankoon (Officer-in-Charge, Smallholdings Advisory Service), Convener.

Mr. B. Mahadeva was nominated in place of Mr. Amarasinghe when the former assumed office as Tea Controller.

Four meetings were held on 1st March, 1st June, 6th September and 6th December.

Appointments Committee.—The Chairman of the Board (Mr. K. G. Sinclair), The Director of Agriculture (Dr. A. W. R. Joachim, O.B.E.—Dr. W. R. C. Paul acting), Mr. J. L. D. Peiris, a further Board member nominated by the Chairman, The Director, T.R.I. (Mr. G. B. Portsmouth).

The following changes occurred during the year:—

Dr. A. W. R. Joachim, O.B.E., resumed his seat in January vice Dr. W. R. C. Paul (acting).

Mr. F. Amarasuriya (Chairman, T.R.I.) vice Mr. K. G. Sinclair as from 28th March.

Dr. A. W. R. Joachim, O.B.E., resigned his seat on 1st August and was succeeded by Dr. E. D. C. Baptiste (Director, Rubber Research Institute) as from 7th September.

One meeting was held during the year, on 24th August.

Buildings Committee.—The Chairman, T.R.I. (Mr. K. G. Sinclair), Mr. J. L. D. Peiris, Mr. G. K. Newton, Mr. F. Amarasuriya, Mr. G. B. Portsmouth.

The following changes occurred during the year:—

Mr. F. Amarasuriya (Chairman, T.R.I.) vice Mr. K. G. Sinclair as from 28th March.

Mr. G. J. Harris took Mr. F. Amarasuriya's ordinary seat as from 1st June.

Mr. M. B. Butler-Cole acted for Mr. G. J. Harris (on leave) from 2nd June until 6th December.

No meetings were held during the year.

Committee of Investigations.—On 2nd March the Board appointed Mr. F. Amarasuriya, Mr. R. M. Macintyre and Mr. D. C. L. Amarasinghe, C.C.S. (Convener), to form a Committee of Investigation to consider the conditions of Service of Senior, Junior and Minor Staff. Mr. B. Mahadeva, C.C.S. took Mr. Amarasinghe's place as from 20th July. Mr. H. S. Amarasinghe, C.C.S., was co-opted to the Committee as from 7th September. The Committee submitted its report in October, and this was considered and adopted by the Board with a few amendments on 2nd November.

Trustees of the Junior Staff Provident Fund.—The Chairman, T.R.I. (Mr. K. G. Sinclair), The Director, T.R.I. (Mr. G. B. Portsmouth), Mr. V. G. W. Ratnayaka, M.B.E., Mr. E. N. Perera representing the Junior Staff, Mr. A. D. McLeod (nominated).

Personnel changes were:—

Mr. F. Amarasuriya (Chairman, T.R.I.) vice Mr. K. G. Sinclair as from 28th March.

Mr. W. H. Gourlay acted for Mr. A. D. McLeod (on leave) from 1st June until 3rd November.

No meetings were held during the year.

Committee of Management, Junior Staff Medical Fund.—The Chairman, T.R.I. (Mr. K. G. Sinclair), The Director, T.R.I. (Mr. G. B. Portsmouth), Mr. G. D. Austin representing the Junior Staff.

The following changes occurred:—

Mr. F. Amarasuriya (Chairman, T.R.I.) vice Mr. K. G. Sinclair as from 28th March.

There were no meetings held during the year.

Visiting Agent.—Mr. G. K. Newton continued as Visiting Agent for St. Coombs Estate. He paid two visits during the year, on 12th March and 23rd/24th September.

Finance.—All sources of income registered decreases as compared to the previous year. Cess collections fell short by Rs. 77,507, profit from St. Coombs estate was less by Rs. 19,872 and income from other sources also registered a decrease of Rs. 3,390. The total income for the year (Rs. 2,230,889) was accordingly less than that for 1955 by just over a lakh of rupees.

Total revenue expenditure (excluding depreciation) amounted to Rs. 1,638,687 as compared with Rs. 1,448,012 for the previous year. The increase in revenue expenditure (Rs. 190,675) was brought about by the continuance of the programme of work on the maintenance of roads and buildings as well as by additional expenditure on sanitation. Expenditure on travelling of staff and the Institute's participation in the Royal Exhibition held early in the year also contributed to the increase.

Capital expenditure for the year amounted to Rs. 359,415 made up by the following items:—Land development Rs. 62,696; Buildings Rs. 184,142; Equipment Rs. 29,367; Furniture Rs. 43,193; Vehicles Rs. 19,473 and Expansion of Vegetative Propagation Rs. 20,544. The total accumulated depreciation as at 31st December, 1956, was Rs. 1,237,243.

After allowing for such liabilities as Furlough Pay and Passages (Rs. 100,744), Smallholdings Advisory Service (Rs. 109,102), Sundry Creditors (Rs. 196,075), net Liquid Assets as at 31st December, 1956, amounted to Rs. 2,272,081.

A start was only made, late in the year, on the extensive development programme referred to in the previous year's report. Consequently no expenditure on such work was included in the year's accounts.

Smallholdings Advisory Service.—The income for the year was made up chiefly by the annual grant of Rs. 300,000 from the Institute. Other items which contributed to the total of Rs. 328,803 were interest Rs. 11,783, profit on manure and tea seed Rs. 11,470, profit on sale of assets Rs. 4,000 and miscellaneous receipts Rs. 1,550.

Revenue expenditure, excluding depreciation, amounted to Rs. 217,799 for the year. Excess of income over expenditure (excluding depreciation) was, therefore, Rs. 111,004.

Capital expenditure amounted to Rs. 15,338, the chief item being a new cinema van (Rs. 13,520). The balance comprised field and office equipment.

New Liquid Assets as at 31st December, 1956, amounted to Rs. 486,805 after allowing for liabilities, but excluding depreciation. Rs. 295,575 of this amount has been invested in Ceylon Government Loans.

St. Coombs Estate.—The year's working account was closed with the estate making a profit of Rs. 288,602 as compared with Rs. 308,474 in 1955. The crop harvested for the year was 246,420 lbs. giving a yield per acre of 922 lbs., as compared with a crop of 298,763 lbs. and a yield per acre of 1,104 lbs. in 1955. Unusual weather conditions prevailed during the year. Prices realised for St. Coombs teas, however, compensated for the shortfall in crop and were always above the high grown average. A record price of Rs. 6/25

per lb. was fetched in the sale of 16th March, 1956. The net sale average was Rs. 3/08 as compared with Rs. 2/71 in 1955.

Publications.—The 'Tea Quarterly', Vol. XXVII was published as usual. Parts 1 and 2 appeared as a combined number, and Parts 3 and 4 were issued as separates. Bulletin No. 37, Annual Report for 1955, was also published in the latter half of the year. Monograph No. 4 'Tea Manufacture in Ceylon' by Mr. E. L. Keegel was issued in June. This publication aroused considerable interest and there was such a widespread demand for it, which, as well as from Ceylon, came from other tea growing countries, particularly from India, that the entire stock of 3,500 copies was exhausted in a very short space of time.

Receipts from subscriptions and sundry sales amounted to Rs. 6,647 and from advertisements to Rs. 5,200. Cost of printing and distribution amounted to Rs. 34,235, of which the printing of Monograph No. 4 alone cost Rs. 16,507.

Acknowledgements.—Once again it is a pleasure to report that the Institute continued to receive the fullest co-operation from the Ceylon Association in London, the Planters' Association of Ceylon, the Agency Section, Planters' Association of Ceylon, Agency Houses, Engineering Firms and various other bodies concerned with the tea industry in Ceylon. The Board is deeply grateful to all of them.

Particular mention must be made of the Planters' Association of Ceylon for having readily made available their meeting room for meetings of the Board and its various Committees.

Accounts.—Messrs. Ford, Rhodes, Thornton & Co. continued to act as the Institute's Auditors. The Audited Statement of Accounts and the Balance Sheet for the year ended 31st December, 1956, are attached to this report.

G. B. PORTSMOUTH,
Secretary.

THE TEA RESEARCH INSTITUTE OF CEYLON

BALANCE SHEET AS AT 31st DECEMBER, 1956.

1955				1955					
		Rs. Cts.	Rs. Cts.	Rs.			Rs. Cts.	Rs. Cts.	
	Accumulated Fund:—					**Fixed Assets:—**			
	Expended on Fixed Assets—				3,597,046	Cost	Rs. 3,849,636.34		
	Balance as 1st January, 1956	3,849,636.34			275,962	Additions 1956	„ 359,414.85		
	Additions less disposals during the year	316,537.58	4,166,173.92		3,873,008		Rs. 4,209,051.20		
	Unexpended Fund—					*Less:* Sales and scrapped in 1956			
	Balance at 1st January, 1956	889,946.02		3,849,636	23,372	at cost	„ 42,877.28	4,166,173.92	
	Less: Additions to Fixed assets less disposals during the year	316,537.58			1,030,580	*Less:* Depreciation—As at 31st December, 1955 ...	Rs. 1,116,084.78		
		573,408.44			116,128	Depreciation 1956 ...	„ 130,781.58		
	Add: Excess of Income over expenditure for the year 1956	461,430.55	1,034,838.79		1,146,708		Rs. 1,246,866.36		
4,739,582			5,201,012.71	1,116,085	30,683	*Less:* Depreciation on items scrapped or sold	9,623.57	1,237,242.79	
				2,733,551					2,928,931.13
105,696	**Creditors and Provisions**		196,075.28						
108,840	**Provision for Furlough Pay and Passages**		100,744.53			**Investments at Market Value:—**			
					237,075	Ceylon Government Securities		224,150.00	
194,966	**Small Holdings Advisory Service**		109,011.70	299,438	62,363	United Kingdom Government Securities		45,649.53	269,799.53
	Note.—Capital commitments not provided in the accounts amounted to approximately Rs. 565,000/-.					**Current Assets:—**			
				188,599		Debtors—General		315,368.41	
				20,600		Debtors and Other Debit Balances—Research ...		54,724.12	
					24,919	Debtors—Staff—			
						Loans	Rs. 64,581.49		
				30,867	5,948	Kerosene cookers ...	„ 3,653.75	68,235.24	
				16,855		Deferred expenditure		—	
				143,590		Stocks		198,303.76	
				1,715,784		Cash in hand and at Banks		1,771,482.03	2,408,113.56
5,149,084			Rs. 5,606,844.22	5,149,084				Rs.	5,606,844.22

We have examined the above balance sheet with the books of the Tea Research Institute of Ceylon and St. Coombs Estate and have obtained all the information and explanations we have required. In our opinion the foregoing balance sheet is properly drawn up so as to exhibit a true and correct view of the financial affairs of the Institute as at 31st December, 1956, according to the best of our information and the explanations given to us and as shown by the books.

(*Signed*) FORD, RHODES, THORNTON & Co.,
Chartered Accountants.

Colombo, 28th May, 1957.

THE TEA RESEARCH INSTITUTE OF CEYLON.

SUMMARY OF FIXED ASSETS AND VEHICLES—31st DECEMBER, 1956.

	ASSET ACCOUNT				DEPRECIATION ACCOUNT				
	31-12-55	1956	Deduct Sales and items scrapped 1956 at cost	Cost at 31-12-56	Accumulated to 31-12-55	Depreciation 1956	Depreciation on items scrapped or Sold	Accumulated to 31-12-56	Written down Value 31-12-56
	Rs. Cts.	Rs. Cts.	Rs. Cts.	Rs. Cts.	Rs. Cts.	Rs. Cts.	Rs. Cts.	Rs. Cts.	Rs. Cts.
Land including Development	1,100,750.63	62,695.89	—	1,163,446.52	69,984.30	4,159.85	—	74,144.15	1,089,302.37
Buildings and Lines	1,853,375.57	184,141.62	42,132.33	1,095,384.86	694,670.12	54,339.59	9,577.82	739,431.89	1,255,952.97
Furniture and Equipment	267,575.06	27,968.47	592.45	294,951.06	61,603.52	15,715.52	—	77,319.04	217,632.04
—do— Board of Survey	66,874.06	13,417.08	—	80,291.14	—	—	—	—	80,291.14
Laboratory Equipment	106,214.81	28,798.03	—	135,012.84	61,871.06	6,407.82	—	68,278.88	66,733.96
Experimental Machinery	69,544.92	—	—	69,544.92	39,816.84	6,954.49	—	46,771.33	22,773.59
Estate Machinery	156,492.47	—	—	156,492.47	156,492.47	—	—	156,492.47	—
Workshop Machinery	25,006.67	—	—	25,006.67	5,001.32	2,500.66	—	7,501.98	17,504.69
—do— Equipment	12,690.47	568.75	152.50	13,106.72	2,284.69	1,269.04	45.75	3,507.98	9,598.74
—do— Furniture	1,796.75	1,807.75	—	3,604.50	—	—	—	—	3,604.50
Institute Vehicles	77,425.55	15,632.50	—	939,058.05	6,203.76	19,356.38	—	25,560.14	67,497.91
Workshop Vehicles	43,184.18	3,840.20	—	47,024.38	9,731.59	10,778.51	—	20,510.10	26,514.28
Library Shelving	2,391.78	—	—	2,391.78	—	—	—	—	2,391.78
Spectrophotometer	13,589.46	—	—	13,589.46	—	1,358.94	—	1,358.94	12,230.52
Leaf Hoist	2,055.38	—	—	2,055.38	1,541.50	513.88	—	2,055.38	—
Lawn Mowers	767.78	—	—	767.78	401.77	76.77	—	478.54	289.24
Monkey Grubber	2,534.77	—	—	2,534.77	1,267.35	253.47	—	1,520.82	1,013.95
Dusters, Sprayers and Pumps	20,923.68	—	—	20,923.68	4,143.64	2,092.36	—	6,236.00	14,687.68
Leaf Elevator	10,708.55	—	—	10,708.55	1,070.85	1,070.85	—	2,141.70	8,566.85
Winget Stone Crusher	15,733.80	—	—	15,733.80	—	3,933.45	—	3,933.45	11,800.35
Vegetative Propagation Expansion	—	20,544.57	—	20,544.57	—	—	—	—	20,544.57
Rs.	3,849,636.34	359,414.86	42,877.28	4,166,173.92	1,116,084.78	130,781.58	9,623.57	1,237,242.79	2,928,931.13

ESTATE WORKING ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1956.

1955 Rs.		Estate Expenditure—Revenue:—	Rs. Cts.	Rs. Cts.	1955 Rs.		Tea Sales—Gross Proceeds:—	lbs.	Rs. Cts.	Rs. Cts.
	121,300	General charges	... 139,639.63			787,736	Colombo	235,495	759,906.09	
	80,743	Upkeep	... 80,413.43			4,067	Local	1,579	4,353.43	
	48,975	Cultivation	... 46,393.38			4,286	Broken mixed	6,995	4,157.85	
	113,830	Harvesting	... 105,112.78			296	Biochemical department	58	106.72	
	99,804	Manufacture	... 84,460.25			—	Gratis	2,293	—	
464,652				456,019.47	796,385			246,420		768,524.09
13,564		Bonus to staff	...	14,200.00						
10,788		Colombo Brokerage and handling charges	...	9,989.08						
308,474		Balance to Income and Expenditure account ...	...	288,601.98	1,093		Profit on sale of Guatemala Grass			286.44
797,478			Rs.	768,810.53	797,478				Rs.	768,810.53

THE TEA RESEARCH INSTITUTE OF CEYLON.

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31st DECEMBER, 1956.

1955 Rs.		Rs. Cts.
102,665	Administration of the Board	109,598.97
263,203	Senior Scientific Staff	248,078.02
129,065	Junior Scientific Staff and Minor Employees	126,991.96
27,182	Laboratory	29,527.43
21,219	Library and Publications	36,782.46
88,770	Field and Factory experiments	110,972.00
53,787	Travelling of Staff	63,883.60
43,014	Engineering department	43,427.74
13,359	Maintenance of Buildings	39,879.84
128,076	General Services	256,937.92
146,466	Miscellaneous	197,597.55
300,000	Small Holdings Advisory Service	300,000.00
81,869	Board of Survey—Buildings Maintenance	58,441.38
17,802	Endane experiments	6,930.22
15,861	Mooloya experiments	—
5,841	Loss on Working Stone Crusher	—
9,832	Factory decorations	—
116,128	Depreciation	130,781.58
—	Depreciation of investments	9,638.29
767,529	Balance being excess of income over revenue expenditure for the year ended 31st December, 1956	461,430.35
2,331,668		Rs. 2,230,899.31

1955 Rs.		Rs. Cts.
308,474	Balance from Estate Working account	288,601.98
1,990,504	Tea Cess	1,912,996.64
12,639	Interest	19,673.46
1,800	Rent of Cadday	1,800.00
—	Profit on Stone Crusher working	7,827.23
382	Profit on Austin Tipper working	—
17,869	Profit on sale of Fixed Assets	—
2,331,668		Rs. 2,230,899.31

REPORT ON ST. COOMBS ESTATE FOR THE YEAR 1956

Staff.—Following the retirement of Mrs. M. A. Perera a young qualified Government trained midwife, Miss G. Yasohamy, was taken on as from 1st April, 1956.

A new plucking K.P., S. T. Ponnusamy, was appointed as from 2nd February, 1956, to replace P. Kandasamy.

All other staff appointments remain the same.

Acreage.—

		A.	R.	P.
Tea in bearing	...	267	3	00
New clearing	...	19	3	28
Green manure clearing	...	12	0	00
Land fit to open in tea	...	5	3	00
Buildings and gardens	...	49	2	11
Fuel clearings	...	36	3	14
Waste land and ravines	...	32	0	24
		423	3	37

The acreage statement has altered slightly from 1955 figures by an increase of ½ acre in full bearing, caused by the 2½ acres of No. 10 new clearing and 2 acres of No. 1 new clearing being brought into bearing, and a deduction of 4 acres by uprooting of tea for building sites in Nos. 9 and 10 field and the extension of the T.R.I. clonal area in No. 9 field.

Weather.—(Estate gauge).

		Rainfall inches	*Wet days*	*Sunshine hours*
Registered in 1956	...	87.37	226	1879
Registered in 1955	...	90.23	220	1739
(Decennial average 1946—55)	...	90.53	231	1848

Extremely unusual weather conditions were experienced in 1956. Following dry weather in December, 1955, the drought continued untilMarch, 1956, and even then the rain was totally inadequate to have any lasting effect until the end of May. Total rainfall to the end of May for the year was 15.06″ as against 32.16″ to the same date 1955, and 26.44″ on the decennial average. Severe frost was experienced in February, causing considerable loss of crop with an estimated 50 acres of tea out of bearing. June proved to be an extremely wet month and with only a slight improvement in July, severe south west monsoon continued without any appreciable break until October. Rainfall in December was again on the low side.

Crop.—

	1956	1955
	lbs	*lbs*
Estimate	270,000	270,000
Total crop (including off grades)	246,420	298,763
Yield per acre on 267¾ acres ...	922	—
Yield per acre on 267¼ acres ...	—	1,104

Crop for the year was not as high as expected due entirely to the unusual weather conditions. The highest yielding field, which was also one badly affected by frost, made a quick recovery, despite the early set back, giving a final yield of 1,580 pounds an acre.

Prices and Total Crop Sold.

Year	*Total crop sold*	*Total price*	*Nett price*
	lbs.	*cents*	*cents*
1956	246,420	311.88	307.82
1955	286,834	274.63	270.87

Prices realised were high in comparison with the high grown average and compared favourably with district estates.

Cost of Production.—

	1956	1955
	Cost per lb. (Cts.)	*Cost per lb. (Cts.)*
Estimate ...	171.68	171.92
Actual	185.05	155.42

Profit on Estate Working.—

1956	...	Rs. 288,601.98
1955	...	Rs. 308,474.31

Capital Expenditure.—

1956	...	Rs. 98,399.47	39.93 cts. per lb.
1955	...	Rs. 58,703.82	19.66 cts. per lb.

The expenditure here was:—

Waterborne sanitation to lines ...	Rs.	702.80
Buildings	,,	5,493.51
New clearings	,,	46,657.70
Ravines to be cleared	,,	4,143.15
Factory	,,	9,887.93
New lines	,,	30,506.38
Furniture	,,	1,008.00

Plucking.—The standard of plucking was maintained throughout the year, rounds being 7 to 8 day intervals. The individual row system continued in the new fields but due to the continual labour requirements of the T.R.I. the system did not prove as efficient as hoped.

Estate Roads and Paths.—Considerable work was carried out during the year on the improvement of the field foot paths. The main internal estate cart road has been almost completely relaid under the supervision of the Maintenance Engineer.

Fuel Clearings.—The system of rationing introduced in 1955 for firewood issues continued in 1956 and adequate supplies of firewood were made available throughout the year, but prospects for 1957 in this respect are not very good. An extensive programme of supplying grass ravines with gum plants was carried out during the year and considerable work was done in draining swamp areas to make them available for fuel clearings in the future. The *Eucalyptus saligna* plants from the Forestry Department have taken very well and the growth in comparison with the normal red gum, *E. Robusta*, seems to be very similar.

Ravines and Boundaries.—The extensive drought early in the year gave ample opportunity for considerable work to be carried out on cleaning up ravines and field boundaries. The main stream running through the lower section of the estate from Mattakelle boundary past the factory to Waltrim boundary was deepened and widened throughout its entire length, in an effort to prevent the annual flooding of the low lying areas. The estate boundaries between St. Coombs and surrounding estates have practically all been freshly demarcated by cutting deep boundary drains, reversed slope, on the steeper sections.

Weeding.—The average cost of weeding was again reduced from Rs. 10/66 per acre per round in 1955 to Rs. 10/16 per acre per round in 1956, and there is every hope that costs will be further reduced in 1957.

Pests and Diseases.—Routine control of blister blight, using standard copper fungicides and spray equipment commenced in May and continued until November, when weather conditions improved and only the new fields were sprayed until the end of December. The OC-02 nozzles were replaced at the beginning of the year, but after only a few months normal wear, the spray pattern had changed so considerably that a further complete set of new nozzles were purchased and fitted. The original American OC-02 nozzles proved to be highly satisfactory and in fact lasted for two complete spraying seasons without any appreciable alterations in droplet size or spray pattern, but the nozzles subsequently purchased do not appear to be as satisfactory.

Several large scale spraying and dusting experiments were carried out by the T.R.I. and Messrs. Fisons Pest Control Ltd., using the whole of No. 2 field, part of No. 3 field, 15 acres of No. 4 field, the whole of No. 6 field, a small area of No. 10 clonal area and 2 acres of No. 13 field recovering from pruning. These areas were taken over at the beginning of the south west monsoon and returned to the estate in September for subsequent blister blight control.

Loranthus creeper is now practically under control with the exception of some bad patches in the grevilleas in some of the experimental areas.

Poria gave little trouble and only isolated bushes were infected which received immediate attention.

Following the severe drought heavy mite attacks were noticed but with the onset of the wet south west monsoon weather, the attacks soon disappeared.

Following the severe frost in February, a sanitary prune was carried out on the damaged bushes in Nos. 9 and 10 field cutting back below the original pruning level to below the damaged tissue. This severely retarded growth in these fields and delayed tipping by several months. These areas were subsequently sprayed with an excess lime—Bordeaux mixture to prevent further damage. The worst affected bushes still showed signs of wood rot at the end of the year. Low lying sections of No. 12, 13, 14A and 14B affected by frost were skiffed to below the damaged shoots and later tipped and brought back into plucking. Recovery in these areas was extremely good and overall yields from the fields remained high.

Pruning.—The pruning programme for the year was modified slightly, to give longer cycles and to eliminate as far as possible pruning into the dry weather period. The type of prune remains the same, light cut across on the slope, but some attention was given to removing knotty branches where necessary. Field No. 5, due to be pruned in October/November, was left and will run until April, 1957. The growth of wood in No. 13 field was extremely good and no cleaning out was found necessary. No. 7 and 8 fields, however, did not show so much new growth as No. 13 field probably due to the very mixed type of tea prevalent in these fields.

Supplying and Nurseries.—There was a large excess of V.P. plants above the requirements of the new clearings and these were supplied to the larger vacancies in all the fields, and to the cleared ravines in Nos. 2 and 4 field. All the plants were supplied in large baskets and a high percentage of success achieved. The nursery extension in No. 12 field of No. 2 nursery was supplied with clonal plants and the nursery proper handed over to the Physiology Department for soil rehabilitation experiments.

Mossing and Ferning.—The estate weeding contractors removed all fern in their respective contracts immediately after pruning and the pruned areas were sprayed with lime to control moss and lichen.

Working up Poor Areas.—Due to the revision of the pruning programme, the thatching with Guatemala grass of No. 5 field as estimated, was postponed until 1957, and No. 7 field pruned in August was thatched instead with 8 tons of Guatemala grass per acre.

Manuring.—The same system of manuring was continued throughout the year but the manure was dibbled into the soil, using 3-prong drag cultivators in place of forks. These cultivators appear to be most satisfactory for this work and have the advantage that little root disturbance takes place. It may be necessary, however, to revert to forking for one application, during a pruning cycle in fields where the soil shows any tendency to pan, although there have been no indications of this happening on St. Coombs so far.

The following are details of nitrogen and potash applied to individual fields, using T.R.I. 488 mixture:—

Field No.	Months manured	1954 Nit.	1954 Pot.	Months manured	1955 Nit.	1955 Pot.	Months manured	1956 Nit.	1956 Pot.
1	July	46	22	*	—	—	Nov. **	36	17
2	Sept.	43	20	April	43	20	March	46	22
	Dec.	36	17	Sept.	46	22	Sept.	40	19
3	Sept.	53	25	April	43	20	March	46	22
	Dec.	36	17	Sept.	46	22	Sept.	40	19
4	Jan.	53	25	Feb.	46	22	April	40	19
	Aug.	56	26	Oct.	36	17	Sept.	53	25
5	June	59	28	May	53	25	May	36	17
	Dec.	43	20	Nov.	46	22	Nov.	40	19
6	April	63	30	May	40	19	May	36	17
	Oct.	43	20	Nov.	53	25	Nov.	46	22
7	July	53	25	May	46	22	May	40	19
	Dec.	43	20	Nov.	53	25	Nov.	36	17
8	June	66	31	May	59	28	May	40	19
	Nov.	53	25	Nov.	53	25	Oct.	36	17
9	April	66	31	March	53	25	May	43	20
	Oct.	46	22	Sept.	46	22	Nov.	40	19
10	March	73	34	Jan.	56	26	May	36	17
	Aug.	59	28	May	46	22	Nov.	40	19
				Oct.	46	22			
11	April	69	32	May	40	19	April	46	22
	Dec.	53	25	Oct.	53	25	Aug.	53	25
							Dec.	46	22
12	May	43	20	May	63	30	April	46	22
	Nov.	53	25	Oct.	46	22	Sept.	53	25
							Dec.	40	19
13	May	69	32	April	56	26	March	53	25
	Nov.	59	28	Sept.	46	22	Oct.	36	17
14A	Jan.	63	30	Jan.	56	26	July	59	28
				July	56	26	Nov.	43	20
				Dec.	56	26			
14B	Jan.	53	25	Jan.	56	26	July	63	30
	June	66	31	July	56	26	Nov.	56	26
				Dec.	59	28			

* The whole field was uprooted.

** 2 acres of new clonal area manured.

Green Manure and Shade Trees.—Normal routine supplying following the long term green manure and shade tree programme was carried out in all young and pruned fields. *Grevillea robusta*, *Albizzia sumatrana*, *Albizzia moluccana* and dadaps being used except in No. 2 field where *Tecoma* plants are being maintained in place of dadaps or *Albizzia moluccana*.

Replanting of Old Tea.—Routine upkeep of No. 10 new clearing 1954 planted area continued until July when the area was brought into bearing. Some resupplying was done in the lower section to replace bushes killed by frost but there were very few vacancies over the rest of the area. Yield records from the 1952 planted area have unfortunately lapsed due to experimental work being carried out in certain clones in that section. Yield records of the 1954 planted area, however, will be maintained.

The uprooting of tea in No. 1 field, which commenced in January 1955, was not completed in that year and the small balance remaining was only finished in March 1956, with a total of 28,292 bushes being uprooted in those 3 months.

The nursery in No. 12 field was extended considerably to accommodate the basket plants required for the 1956 planting. Large areas of No. 1 were completely replanted with alternative clones where the success of the original planting was so poor as to make resupplying with the original clones unsuitable. In other areas, where the percentage of success of the 1954 planting was better, resupplying of vacancies was carried out. A total of 22,371 plants were put out and 36,693 hedge plants supplied on the drain and roadsides throughout the whole of the uprooted area. All supplies were protected with large protection baskets. The 2024 block planted in 1953 and the 2024 block planted in 1954 were brought into bearing in June and yield records of these two areas are being maintained. Normal routine supply of shade trees, lopping Guatemala grass, contour lining, trenching, etc., were carried out as and when necessary.

Considerable work was done in cleaning many of the narrow grass ravines to extend the tea areas. All such cleared ravines were consolidated with masonry.

Poria infected bushes were again found in the 2024—1954 planted area, giving a further indication of the necessity for soil rehabilitation prior to planting in tea; this area being the experimental block where plants were supplied immediately after uprooting without the recommended period under Guatemala grass.

Factory and Machinery.—Further improvements were made to both factory and machinery during the year. Fluorescent lighting was fitted in the firing and bulking room and it is proposed, in view of the improvement these lights have made, to fit similar types of fluorescent lighting to other parts of the factory ground-floor next year.

A covered way from the furnace verandah side of the factory to a converted store room for patent chest manufacture was completed and a thermostat controlled heating unit will be fitted to maintain even temperature and humidity in this room next year.

The 'Darvic' white plastic bowls (Messrs. Imperial Chemical Industries (Export) Ltd.), first introduced in 1955 for use in the rolling and sifting rooms, have proved very satisfactory in their 18 months of service, and would appear to have a considerable life yet.

Messrs. William Jacks & Co. (Ceylon) Ltd., provided two samples of stainless steel shovels for bulking and handling rolled leaf, which appear to be very satisfactory.

Messrs. The Shell Co. of Ceylon Ltd., carried out a lubrication survey of the factory and their charts for each machine, giving recommended lubricants, are proving most useful.

The patches of 'Flintkote' flooring laid by the same Company are standing up very well to the normal routine wear and tear in both the rolling room and drying room and would appear to be superior in many respects to normal concrete floors.

All the factory machinery was carefully checked and repairs carried out when necessary. Counterbalance weights and special door release gears were fitted to the two double action rollers and one single action roller by the Engineering Department, and these have eliminated damage to the doors, the leaf trolleys and the lock mechanisms which, in the past, continually required attention.

Work commenced on an automatic belt feed mechanism to the C.C.C. rotary rollbreaker and when completed should greatly assist charging the rollbreaker. This work was carried out by Mr. Opatha, of the T.R.I. Engineering Department, who was responsible for designing this machine and the release gear mechanism on the rollers. The 30″ wide conveyer belting for the rollbreaker feed was supplied by Messrs. Fenners Ltd., for test purposes, and consists of a white plastic covered material which should be hard wearing and hygienic.

Labour.—With the unusual drought early in the year, some difficulty was experienced in finding adequate work for both men and women at that time, but the situation improved with the onset of the south west monsoon and later in the year a few children were registered.

A new double storey line for 4 families was completed according to Dr. Macdonald's revised plan No. EHS/LQ/14. This line incorporates water-borne sanitation, sinks, running water and airing cupboards, and appears to be appreciated by the large families at present occupying the rooms.

Manufacture.—The type of manufacture was altered from continuous rolling to a 4-roll programme with quick withers and short fermentations during the quality months and gave considerable improvement in flavour to the normal teas, but continuous rolling was re-introduced when weather conditions became more normal.

General.—1956, despite the shortfall in crop, was still satisfactory as far as the tea prices realised. The general appearance of the tea apart from those areas severely affected by frost and drought remained satisfactory, and there appears to be no reason why the yield for 1957 should not be well over 1,000 pounds per acre in line with previous years.

E. S. ROSE,
Superintendent.

METEOROLOGICAL OBSERVATIONS — 1956
ST. COOMBS
(Laboratory Gauges)

MONTH	TEMPERATURES °F						Mean Relative HUMIDITY %	RAINFALL		RAINY DAYS		SUNSHINE	
	Mean Maximum	Difference from average (25 years)	Mean Minimum	Difference from average (25 years)	Adopted Mean	Mean on grass		Inches	Difference from average (25 years)	Days	Difference from average (25 years)	Hours	Difference from average (25 years)
January	73.6	— 0.5	52.0	— 3.7	62.8	51.4	73	1.04	— 2.56	7	— 4	245.60	+ 52.90
February	75.7	— 0.6	51.3	— 3.3	63.5	49.5	65	0.10	— 2.25	3	— 5	251.18	+ 40.50
March	77.1	— 0.6	54.1	— 1.4	65.6	55.3	72	3.86	— 0.68	12	—	229.30	— 3.71
April	76.4	— 1.0	56.6	— 1.2	66.5	59.9	78	5.01	— 1.36	18	+ 2	207.15	+ 10.71
May	71.2	— 1.2	59.2	— 0.5	65.2	59.3	85	4.98	— 6.30	19	+ 1	156.75	— 7.25
June	67.7	— 2.9	59.6	— 0.8	63.7	58.8	92	26.21	+ 13.11	25	— 1	63.17	— 28.87
July	68.6	— 1.6	58.7	— 0.8	63.7	57.1	88	6.70	— 5.04	22	— 4	106.27	+ 1.08
August	67.5	— 3.5	58.0	— 1.2	62.8	54.7	86	11.32	+ 1.90	28	+ 3	51.27	— 62.89
September	67.9	— 4.3	58.8	+ 0.6	63.4	56.6	90	7.73	— 0.64	25	+ 4	80.75	— 59.57
October	70.6	— 2.5	58.5	+ 0.8	64.6	57.1	85	8.63	— 1.06	22	—	123.45	— 25.91
November	72.7	— 0.8	56.4	— 0.7	64.6	55.0	67	13.17	+ 5.75	24	+ 5	168.67	+ 7.15
December	73.8	+ 0.3	55.3	— 0.8	64.6	53.9	71	2.39	— 2.83	11	— 4	195.50	+ 26.27
	71.9	— 1.6	56.5	— 1.1	64.3	55.7	79	91.14	— 1.96	216	— 3	1879.06	— 49.59
	Means							Totals					

REPORT OF THE DIRECTOR FOR THE YEAR 1956

The year was marked by an unusual number of senior staff changes, which necessarily involved a certain amount of reorganisation of the work of some of the departments.

Mr. C. A. Loos, Pathologist, resigned and left to take up a nematological appointment in America in February. As a consequence both nematology and mycology had once again to be combined in a single pathological department under Mr. B. N. Webster.

Dr. B. A. Baptiste, Entomologist, also left St. Coombs in May, when Mr. G. D. Austin took over charge of the department. During the same month the newly appointed Plant Physiologist, Dr. T. Visser, arrived from Holland and assumed duties.

Another resignation during the year was that of Mr. T. E. Walter, the Low-Country Scientific Officer, who left the island in August. This post was not refilled. Instead Dr. A. W. R. Joachim, O.B.E., a former Director of Agriculture, was appointed in September as Adviser to the Board for two years to report on and supervise the establishment of an adequately staffed and equipped Low-Country Sub-Section.

The Technologist, Mr. E. L. Keegel, was also away from St. Coombs from April onwards on a Colombo Plan Fellowship awarded him by the United Kingdom Government. This resulted in a considerable reduction in the amount of advisory assistance in connection with manufacture which it was possible for the Institute to provide during the year. However, Mr. Keegel's absence was to some extent offset by the publication and general distribution of his very comprehensive book on 'Tea Manufacture in Ceylon' as Monograph No. 4. This book was very well received by the industry and undoubtedly served to answer many questions which would otherwise have been submitted to the technology department.

Arising directly out of the staff position the Board appointed a special Committee of Investigation to consider the conditions of service of Senior, Junior and Minor Staff. The Committee went into everything very thoroughly and met to hear personal representation by various members of the staff both at St. Coombs and Gampola. Their report and principal recommendations were accepted by the Board in November and will be effective as from the 1st January, 1957. One of the principal changes is the creation of a new Intermediate Staff class to which Messrs. M. S. Ramaswamy, F. H. Kehl, W. T. Fonseka and A. C. Perera are being promoted. Full details of the various changes in salary scales and conditions of service approved by the Board are given in the minutes of the November Board meeting which are being published in the *Tea Quarterly*.

Participation in the Royal Agricultural and Food Exhibition, held in Colombo in January and February, took up much staff time and involved the

Institute in expenditure of over Rs. 31,000/-, none of which was, as had been hoped, recoverable from Government. However, it is pleasing to record that the Institute's stall was well in the running towards being voted the best display in the Exhibition.

In conjunction with the Sabaragamuwa Planters' Association a Symposium on shot-hole borer, at which the technical views of research officers and the experiences of practical planters were freely exchanged and discussed, was held in Ratnapura on the 14th September. The official opening of the Symposium by the Hon'ble Mr. D. P. R. Gunawardena, Minister of Agriculture and Food, served to underline the importance of the shot-hole borer problem in relation to Ceylon's tea industry. The proceedings were published in full in the December issue of the *Tea Quarterly* (Vol. XXVII, Pt. IV).

The Director also attended the Second International Plant Protection Conference held at Fernhurst in June.

Implementation of the first stage of the new water supply scheme began during the year with the signing in September of a contract with Messrs. Brown & Co., Ltd., for the construction of the new dam. It is hoped that the work will be completed in time for the storage-reservoir, which will hold over 8 million gallons, to be filled during the next south west monsoon.

The large scale contour survey of the development area on St. Coombs was completed early in the year and confirmed the suitability of the sites provisionally chosen for the new staff quarters. In this connection our thanks to the Directors of the United Planters' Co. of Ceylon, Ltd., for agreeing to the exchange of a small adjoining area of Mattakelle estate are gratefully recorded. Unfortunately implementation of the building programme was affected by the Suez crisis, as the consequent rise in the cost of materials held up the signing of the contract with Messrs. M. Y. Hemachandra & Co., Ltd. However, it was eventually decided to proceed with the construction of only 3 senior staff quarters instead of the 4 originally approved and work was finally under way by the end of the year.

Plans for a new wing for the Guest House were also approved by the Board and construction work started. When completed this should largely obviate the necessity for official visitors to the Institute having to be accommodated by members of the staff, as is frequently the case at present.

On St. Coombs estate adverse weather conditions prevailed throughout most of the year, with the consequence that the crop was considerably behind that secured for 1955. However, the consistently high prices realised by St. Coombs teas on the Colombo market enabled the estate to maintain a profit level only slightly below that of 1955. This excellent result once again demonstrates the great importance of maintaining a consistently high standard of quality in the made teas.

Details of the work carried out by the Institute during the year will be found in the various reports which follow.

G. B. PORTSMOUTH,
Director.

REPORT OF THE AGRICULTURAL CHEMIST FOR THE YEAR 1956

General.—The staff remained unchanged during the year.

The majority of the laboratories have been renovated, and full use has been made of various plastic sheetings, and of plastic emulsion paints. It is already evident that these changes are helping in our constant war against dust, and that the psychological effect of pleasant working surrounds is reflected in the output of work.

Weak points in the original design of our large fume cupboard have necessitated extensive alterations and serious inconvenience, and this may serve as a warning that any future chemical laboratories must be designed by those with knowledge of the operations to be carried out in them, and of possible reactions between chemical by-products and the construction materials.

We can look forward to work in 1957 with little hindrance from laboratory inconvenience or from lack of working stocks of equipment of all types.

AGRICULTURAL CHEMISTRY

Soil Survey.—This exploratory survey has been developed and extended, but still along the original lines, namely the comparison of jungle (i.e. forests) and tea soils under varying climatic conditions. Such a comparison can be useful in anticipating the trends of future deterioration of soil under tea cultivation, and bearing in mind the rapid developments which have taken place in tea growing in Ceylon over the past ten years, we consider anticipation to be our best means of defence.

Further organic matter analyses have added to and supported the results quoted in the 1955 Annual Report, and we now have a useful body of data on the distribution of organic matter in top soil over wide climatic ranges, and also the distribution down the soil profile. Combustion carbon analyses are not available yet in sufficient number for the final correlations between this method and the previously quoted dichromate method to be given, but the progress is satisfactory.

The profile pits have been sited in areas selected on the basis of the preliminary organic matter survey, with due attention paid to the rock formations in the locality. Our interpretation of the results of future field experiments will depend to a large extent on our knowledge of the chemical and physical properties of the soil under the experiments, and we intend to fill in the very obvious gaps in this knowledge. This will be a lengthy and unspectacular task, but a most essential one.

Soil Structure.—Soil rehabilitation prior to the replanting of old tea is a subject of present importance, but the maintenance of good physical conditions in the soil at all times is of perennial importance. In conjunction with

the earlier survey we have started a further series of analyses designed to show how the aeration and rainfall percolation properties of the soil may be affected by various factors. Laboratory analyses, such as the agitation of field soil over a bank of graded sieves completely submerged in water, form the basis of this work. As usual, the results will eventually have to be correlated with observations in the field, and with field experiments.

The preliminary results suggest that the actual humus content of the cultivated top soils is not of primary importance in maintaining a large crumb structure, since soils of different elevations sieve out to similar crumb distribution.

Jungle top soils have more stable crumbs, and if we are to discount the effect of a higher humus status this feature could be explained by one or both of two factors, *viz.* the absence of mechanical damage, or, the absence of alternate wetting and drying.

Similar sieving on soil from 6—12″, and from 12—18″, suggests that mechanical damage, *i.e.* walking, forking, scraping, etc., is the more important factor on most soils, but that drying out may assume prior place in some of the mid country soils.

Detailed analyses for organic matter, clay, ferric and aluminium hydroxides, are in progress on the individual crumb size fractions. Three soil layers, as given, are subjected to the wet sieving technique (*a*) while still at field moisture content (*b*) after air drying once. If considered necessary it will be possible to evaluate the effect of repeated wetting and air drying.

These analyses, and others on moisture relations of the soil, are all necessary before we can hope to interpret the simplest field experiments on methods of cultivation, mulching, etc. One of the frequent queries concerns the best placing of organic residues, and we hope to be able to offer a rather more scientific basis in the near future for our recommendations.

Soil Rehabilitation.—Soil rehabilitation after the uprooting of old tea has a more obvious relation to the type of work which we have mentioned, and there is a very great need for experimentation at all levels to find the practical method suited to any one district.

An attempt was made (1) to outline the general principles and to give a guide for local modifications. Where a soil infestation, such as meadow eelworm, is of serious proportions, then the measures given by the Pathology Department to eradicate the pest must be followed before rehabilitation proper can be considered.

Several areas supposedly undergoing rehabilitation with Guatemala grass have been seen which will cause disappointment when planted in tea. Unless this grass is planted thickly enough to give a complete soil cover with the foliage, except for a short period after lopping, it will not fulfil the purpose, and the soil will suffer.

The commonest failing, however, is the lack of manure. In spite of our repeated injunctions, too much Guatemala grass has a permanent yellow green colour, often contrasting with the dark green where the area adjoins lines, etc. Guatemala grass, and related species, are so easy to manage and to propagate that it would be a pity if they got a bad reputation for starving the soil through mismanagement.

There is no reason why other crops should not be used in place of the tussocky grasses, if they conform better to local conditions.

Comments on Manuring Trends during 1956.—Dolomite has apparently been accepted as part and parcel of the normal manuring programme, and by the end of the coming year, 1957, we should be able to arrive at an empirical dosage rate for general application.

The use of a balanced mixture with the nitrogen to made tea ratio of 10 to 100, in place of the maintenance ratio of 8 to 100, has been so widespread that we can see how efficient the higher ratio is where a field has a capacity to increase its yield. As long as we remember the difference between a maintenance ratio and an expansion ratio we need not be worried about the indiscriminate use of inorganic fertilisers.

The possibility of substituting urea for sulphate of ammonia was considered, but the sample of urea available became wet and sticky so rapidly that the idea would have been impracticable. As soon as a free running urea is available in quantity and at a comparable price we shall go into the matter again, as we are not satisfied with the increasing acidity of the soil, which is due to the sulphate of ammonia in the present mixtures.

It is proposed to write an article in a forthcoming *Tea Quarterly* issue on the need for heavy manuring of high yielding clones, as it is not always realised that an abnormally vigorous bush can not give its correspondingly abnormal crop unless it is fed in proportion.

In all our manurial recommendations we try to throw as little strain as possible on the inherent reserves of our soils. Our chemical evidence to date supports what would be expected from a knowledge of the geological history of Ceylon, that the less we draw on the poor nutrient reserves the wiser it will be for the future.

Field Experiments.—Both the experiments which are run by the Chemistry Department, in co-operation with the Superintendents of Abergeldie and Sapumalkande estates, have progressed satisfactorily, and will complete their first cycle under experimental treatment early in 1957. No obvious trends are yet to be seen in the yields.

In conjunction with the Vegetative Propagation Officer we have begun a series of manurial experiments on vegetative propagation nurseries, and for this purpose we built a permanent stone terraced nursery at St. Coombs.

It has long been a complaint of many of the Institute staff that tea nurseries are often under waterlogged conditions more suitable for a paddy bed, and we paid particular attention to drainage when designing the stone terraces and soil beds. Even with well regulated watering, some soils will pack together before the young plants are big enough to survive poor aeration round their roots.

Therefore, the manurial treatments have been distributed across two soils, one which had been planted in Guatemala grass for several years and one which had been under light cultivation with various cover crop species. The maintenance of soil aeration is expected to be very different between these two soils.

If tea behaves similarly to other woody crops, *e.g.*, apple, peach, it may be found that once a soil has been used for a tea nursery a subsequent establishment of tea may not be so successful. This effect may not be entirely due to

the build up of pests or disease organisms. We intend that the present experiment should be repeated when the beds are emptied, so that this point can be checked.

Confirmation would mean that new soil would have to be supplied periodically, a process which would raise several practical points. Large scale replanting may eventually have to be accompanied by the provision of small areas planted under, say, Guatemala grass, to provide the nursery soil.

The manure used in this experiment is Sterameal A, which was chosen for its desirable balance of nutrients, in forms of varying availability, and for its comparative safety. Although we think it is to be preferred to a purely inorganic mixture for nursery work, it is capable of scorching plants slightly, due to the supplementary inorganic potash compounds which are added to the animal meal.

This work has now been taken over by the Vegetative Propagation Officer to be co-ordinated with other experiments.

Leaf Discolourations.—Interest in leaf symptoms has increased, but it must be admitted that our progress in explaining the two commonest patterns has been almost non existent. Leaf diagnosis is too large a subject to be tackled other than as a full line of work, and with the priority given to soil studies we have had to relegate leaf diagnosis to the future.

Observation over the past three years has enabled us to make comments on two types of chlorosis, both of which are common at lower elevations.

One of these, present as an orange yellow mottling on the maintenance leaf below the actively growing flush, commonly occurs on bushes which are affected by shot hole borer, and often is most noticeable during a drought. These associations lead many people into the mistake of assuming that the chlorosis is merely a symptom of either or both of the associated factors. We must emphasise yet again that this chlorosis frequently occurs independently of either shot hole borer infestation or of drought. It would be unwise to ignore the symptom if it represents a separate disruption of the plant's physiology, and we should like to be able to study the problem, to discover whether or not low country tea was liable to suffer from further troubles in the future.

The second chlorosis is found only on rim lungs in low country tea. Whereas all the other chloroses take the form of mottles or diffuse bands of yellowish colours, this one, designated "rim lung chlorosis", is easily distinguished by the tendency to appear as sharp edged ivory coloured patches. These patches may cut right across the mid-rib, or may remain as angular blotches near one edge of the leaf. There may be one or more on a single leaf.

We have not been able to make detailed observations as to the incidence of "rim lung chlorosis", but it is usually conspicuous at the stage of active growth of the young shoots in the centre of the bush, *i.e.* the first growth from the pruning cuts. Adverse weather conditions seem to aggravate the development of chlorosis on the rim lung leaves.

The physiological explanation suggested to us, is that the rim lungs may be deprived of their reserves of nutrients and of water in face of the competition from the young growth on the bush. This is in accordance with observations that chlorotic leaves often regain their green colour, with sometimes a

trace of permanent discolouration, when the young growth is brought into plucking and its rate of development slows down.

This relation between the rim lungs and the rest of the bush represents the reason for the adoption of this type of pruning, and we are not greatly perturbed by a moderate incidence of chlorosis. It is in those fields where the chlorosis is severe, and persists on the lungs perhaps throughout the cycle that we have considered using the incidence of this chlorosis as a measure of the nutritional status of the bush at pruning time. There could be no simple evaluation of this technique until we have far more detailed observations, and joint chemical and physiological field experiments.

Our advisory recommendations on low country manuring, in particular for the high yielding fields, are tending towards the idea that the pruning period should be considered as though a full crop were being taken.

A final word concerning the posting of discoloured leaves to the Institute for examination. These leaves are more liable than healthy leaves to turn brown and to dry out, especially if their transit is delayed, and they must be packed in some protective covering, such as polythene, or even the ubiquitous plantain or canna leaf. A box is essential to prevent mechanical damage, and the sending of actual shoots carrying the leaves in question is preferred, as it may assist us in diagnosing the trouble.

We have found that samples of chlorotic leaves, packed as suggested above, will remain recognisable for over one week.

Advisory Work.—The increase in the number of soil samples analysed for their pH value continues, and the total for 1956 approached 2,000. Unless estates can assist us by carrying out their own routine tests, and only sending to the Institute those samples where the pH value is borderline, we shall be forced to reduce the number of individual samples analysed.

We are glad to report that the volume of routine correspondence has decreased very considerably, and although this is partly due to a transference of letters on nursery soils to the Vegetative Propagation Officer, there has been a real drop in letters properly belonging to the Chemistry Department. We attribute this welcome change to the several notes published in the *Tea Quarterlies*.

Reference

(1) Tolhurst, J. A. H.—Ideas on the Experimental Replanting of Tea. *Tea Quarterly*, 1956, Vol. XXVII. Part III, p. 60.

BIOCHEMISTRY

The work of this department has continued under the supervision of the Agricultural Chemist, and every effort has been made to bring the soil nitrogen cycle programme to a stage where it will provide useful fundamental information. By the end of 1956 this had almost been achieved. Further routine examinations of ammonia and nitrate formation under varied laboratory and field conditions are to be undertaken by the Agricultural Chemistry Department in the future, while the Biochemist, Mr. Ramaswamy, who has conducted the work listed in this report, will be able to concentrate on restoring the original research into the biochemical processes affecting tea manufacture.

Seasonal Variation in Ammonia and Nitrate.—Work on the two plots on St. Coombs, described in the 1955 Annual Report, has already provided interesting data on the ammonia and nitrate balance in this soil in the presence of active tea roots. In addition to the previously mentioned sampling depths of 0—2″ and 2—6″, a third depth of 6—9″ was introduced after eight months to give additional information on the downward movement of the nitrogen fractions. Frequency of sampling is governed by the weather conditions, but is approximately once in two weeks.

Exchangeable potassium analyses were also included in the routine programme at this time, to follow the effect of high ammonium ion concentration, which occurs under certain conditions, on the release of potassium ions into the soil solution.

Installation of soil thermographs was greatly delayed by slowness of delivery, but late in 1956 we began to obtain the first continuous soil temperature records to be made, to our knowledge, in Ceylon. Lack of this type of data has been a serious handicap to the interpretation of many phenomena, and we hope that in 1957 we shall be able to make full use of the two thermographs on St. Coombs, and of four others available for installation in any part of the tea growing area.

The thermographs in the experimental area on St. Coombs, at 4,600 feet elevation, were inserted at 2″ depth and at 4″ depth respectively, without undue disturbance of the covering layer of soil and tea roots. The temperature changes which they will record will be those typical of that area of soil which is presumed to be most active in a tea plantation, namely, midway between the tea rows where the constant traffic encourages the greatest amount of exposure to sun and rain.

Analyses of nitrogen fractions from soil supporting an actively growing crop represent the total effect of the microbial population on the soil nitrogen reserves, as modified by the effect of the crop itself on the microbial by-products. Brief comments on the trends of the results will attempt to sort out these two aspects, as far as we are able to judge the activity of the crop.

Rainwater analyses have shown that the total nitrogen addition per acre per annum is no more than 2 to 3 pounds, with a very uniform distribution over the twelve months.

The tea was pruned in December 1955, and subsequent new growth was killed by frost and drought over a period of several weeks. The soil was covered by a thick mulch of tea leaves, and the moisture content in the top two inch layer fell to 16% while the temperature variation (from individual thermometer readings only) covered a wide range from 17° C to 32° C. Ammonia and nitrate concentrations (always expressed as parts per million of nitrogen on the dry soil) fluctuated greatly until the south west monsoon finally set in with consistently damp and cool weather.

Ammonia averaged	...	8 p.p.m. N
Nitrate averaged	...	12 p.p.m. N

In the monsoon period the soil moisture of this upper layer very soon reached a stable level around 30%, and the temperature variation was from 18° C to 23° C. Fluctuations in ammonia and nitrate were small, with the nitrate values the more variable of the two.

Ammonia averaged	...	3 p.p.m. N
Nitrate averaged	...	3 p.p.m. N

Even when the main monsoon period had given way to warmer conditions the ammonia and nitrate levels showed only a slight tendency to rise.

The 2—6″ layer follows the above trends closely, but with far less fluctuation, and with average ammonia and nitrate levels a little over half those mentioned above.

In the 6—9″ layer the few results to date show very little fluctuation at all, and general levels similar to those in the 2—6″ layer.

Superimposed upon these observations are the effects of forking, *i.e.* disturbance without inversion of the layers, and of manuring. While this provides additional data for eventual correlation, it obviously complicates short term appraisal of effects.

One interesting feature has been the complete absence of effect on either ammonia or nitrate formation when a thorough forking, without manure, was done in the cold monsoon weather. The tea was making so little growth at that time that this phenomenon could hardly be explained by postulating rapid uptake of either or both of the nitrogen fractions by the tea roots.

Once again, we emphasise that this exploratory type of work is a necessary basis for any future field experiment concerning seasonal manuring, cultivation, etc.

Laboratory Nitrogen Studies.—These have occupied a large proportion of the working time, and our aim has been to try to determine a simple series of correlations between the behaviour of soils incubated under highly artificial conditions in the laboratory, and their behaviour in the field. We could not hope for more than an approximate comparison but, as our conditions of work preclude the possibility of doing field nitrogen studies anywhere other than St. Coombs, even an approximation would be of great value.

This programme will be continued by the Agricultural Chemistry staff, and should be brought to a conclusion during the coming year.

Sulphur Contamination of Made Tea.—A diversion in our normal programme was caused by a series of complaints of loss of quality of the made tea, and even of damage to factory structure, brought about by the use of high sulphur content fuel oil in many direct fired driers. Fortunately this problem was soon remedied by a change in the type of fuel oil.

During the course of our experiments it appeared that the greatest damage was probably caused by the sulphur bearing exhaust gases circulating slowly over the wet leaf in the lofts.

Leaf Biochemistry.—This aspect of the work lapsed when our predecessor turned his attention to soil nitrogen studies, but towards the end of 1956 we were able to begin a systematic biochemical programme.

We intend to concentrate on a range of clones, and to go into more detail on the variations in chemical composition of the leaf, bud and stalk fractions of the flush, when sampled at different times of the day and under varying weather conditions.

There is already evidence that changes in organic fractions can take place rapidly, and we can not undertake a systematic study of enzyme activity unless we can be sure of the standardisation of our plant material. For this reason the provision of experimental blocks of several clones, and preferably in several districts, would be a most valuable acquisition to the Biochemist.

J. A. H. TOLHURST,
Agricultural Chemist.

REPORT OF THE TECHNOLOGIST FOR THE YEAR 1956

General.—Under the Technical Co-operation Scheme of the Colombo Plan the Technologist was awarded a scholarship and proceeded to the United Kingdom in April. He was away for the rest of the year and during his absence the Director was in charge of the Department.

The primary object of the Technologist's visit to the United Kingdom was to see how far the most recent advances in industrial technology could best be applied to tea manufacture.

Over 60 places were visited, which included engineering firms, factories, and establishments connected with the tea trade. The opportunity was taken of also studying tea trade requirements, the principles of air-conditioning, tea tasting, and the best method of evaluating tasters' opinions on experimental teas. Besides, the following questions were examined:—

1. Electro static separation of stalk.
2. Packing materials.
3. Factory flooring.
4. Mechanical appliances for transport of leaf and tea in a factory.
5. Pneumatic handling and drying.
6. Sieving machines.
7. Sulphur corrosion.
8. Automatic weighing machines.
9. Belting for transmission and conveying.
10. Withering machines of the future.
11. The L.D.S. system of manufacture (leaf thermac—drum storage—single unit system).

Publications.—Monograph No. 4 "Tea Manufacture in Ceylon" was published, the preparation of which occupied a great deal of time.

Advisory.—The amount of advisory work was again on the increase. Besides 15 factories visited by the Technologist prior to his departure to the United Kingdom, Mr. S. M. Gunaratnam visited 31.

Enquiries in regard to tea manufacture were also at a comparatively high level.

Staff.—The shortage of sufficient staff in the Technology department, which consists of only the Technologist and one assistant, is making it increasingly difficult not only to cope with advisory work but to engage upon investigations which are of vital importance to the industry.

There is the most urgent need for supplementing the meagre resources of this department if some progress is to be made on the possibilities of development arising out of the Technologist's visit to the United Kingdom, and the basic work carried out in the past.

Clonal Manufacture.—A systematic investigation of four high yielding clones was commenced early in the year in order to confirm previous results obtained by the mincing machine technique. The experiment was originally planned to carry out manufacture on the experimental rollers (capacity 30 lb. withered leaf). Unfortunately, owing to insufficient material manufacture was confined to the miniature rollers (capacity 1 lb. of withered leaf). Tests were carried out at monthly intervals, and the teas submitted to tasters in Colombo and London for report and valuation.

The clones selected were Nos. 777, 1114, 1526 and 2024, planted in May 1952, and first plucked in June 1954. At the time manufacture tests were started they had been in plucking for only 1½ years.

The results of these tests were consistent with those obtained in the past, except in the case of No. 777, which has now proved to be better than No. 2024. One possible explanation is that being a rapid fermenter it was not given the optimum period when "rolled" in a mincing machine. Under more normal conditions of rolling a normal period of fermentation probably enhanced its quality.

The general characteristics of these clones can now be described as follows:—

No. 2024 A clone with good colour, strength and quality—full bodied —but with a greenish infusion.

No. 777 About the same strength as 2024, but possessing better colour, quality and flavour. Considered to be the best all round tea of the four and the most valuable.

It has a reddish infusion and is a very attractive tea on the whole, having more of the normal desirable characteristics.

No. 1114 The poorest in comparison, with the least strength and quality. Has a greenish liquor, slightly harsh in character, which makes it somewhat unattractive. The infusion is also not as bright as the others.

No. 1526 Lighter than the rest, but with nice quality as good as, if not, better than 777. A tea which, were it not for its harsh and green character, would fetch a very high price—a type of tea whose value depends on a specialized market.

When flavour was present, it had appreciably better flavour than 2024, and in one instance had some flavour at a time when it was absent in the others.

In comparison with the tea made from one of the best fields on St. Coombs estate, these clones were all valued higher. In colour they were distinctly better though there was no appreciable difference in strength. Nos. 777 and 1526 were distinctly superior in quality.

The comparative average valuations (for 7 manufactures) are given in Table 1.

Table 1.—*Comparative average valuations of the B.O.P. grade (approximate outturn* 60%).

Valued by	Clone 2024	Clone 777	Clone 1114	Clone 1526	Market average
Colombo Brokers	Rs. 2.87	3.20	2.82	3.15	2.61
London Brokers	6s. 1d.	6s. 7d.	5s. 11d.	6s. 3d.	5s. 6d.
London Buyers	5s. 11d.	5s. 10d.	5s. 6d.	6s. 2d.	5s. 6d.

These are only nominal values, but despite the fact that the teas were somewhat not true to type on account of the miniature scale of manufacture, all four clones were above the average. Considering that the material itself was young leaf, it is not difficult to visualize what the results would have been had manufacture been carried out on a full commercial scale with older leaf.

Besides these tests on a miniature scale, preliminary investigations were carried out on the effect of manufacturing 2 clones together. One taster described a blend of No. 777 and 2024 as follows:—"A magnificent liquor, which is extremely coloury, very rich, full and extremely pungent with good flavour—nominal value Rs. 4/00." (Note:—market average at the time Rs. 2.40).

The desirability of replanting with different clones is indicated by these results, but in the absence of more information it is too early yet to say whether a blend of two or more clones of entirely different characteristics would produce equally outstanding teas.

In addition to this work 60 clones were manufactured for 7 estates.

High Temperature Fermentation.—A reference to the investigations carried out on this aspect of manufacture was made in the *Tea Quarterly*, Vol. XXVI, Part 3 (September 1955), page 96. The main conclusions drawn from the results were:—

1. For equal periods, no matter of what length, a lower temperature produces better quality.
2. Strength is not appreciably affected by temperature.
3. Colour is improved considerably at high temperatures, but at the expense of quality.
4. A temperature of over 90° F. appears to be detrimental to all liquoring characteristics.

It must be noted that in these experiments the material used was just one dhool, and the conditions of fermentation were quite unlike those under which leaf is normally fermented in a tea factory.

A more elaborate experimental plant was later constructed and comprised a small chamber with a water bath at the bottom, which was maintained at a predetermined temperature. Air under pressure was forced through the water and leaf spread on perforated trays. The necessary humidification was obtained at high temperatures, but excessive condensation took place.

This plant was capable of accommodating more leaf than that used for the initial trials, and although not technically perfect was used for fermenting all the dhools at a temperature of about 90° F. For purposes of comparison with fermentation at room temperatures the B.O.P. grade was taken.

The results of these experiments to date indicate that, except for colour, liquoring properties are not improved at temperatures of 90° F. or thereabouts. In the light of this evidence, which has been substantiated by previous work, it is undoubtedly advisable to keep maximum rolling temperatures below 90° F. The reader is referred to Monograph No. 4 (pages 55—57) where the question of excessive heat development in rolling is discussed, and what measures are required to assist in preventing it.

Stalk Extraction.—A machine for preliminary tea sorting and introduced by Mr. H. J. Van der Meer, of Indonesia, was tested. The "Prelim" machine, as it was called, was devised to function as a winnower and replace the familiar cutter. The main three features of the machine were:—

1. Breaking of large particles of tea by the application of a very slight pressure against a moving rubber belt over which the tea was carried.

2. The use of centrifugal force for the separation of the lighter material from the heavier stalk, left unbroken by treatment (1).

3. The removal of fluff and fibre.

Since in this process the separation of stalk is effected by slight pressure, a grade such as Pekoe, which can be produced only by customary methods is eliminated. However, it was found that long wiry leaf could easily be separated, as a result of which the preliminary treatment required for the extraction of the O.P grade was needless.

As a winnower the machine was satisfactory, but the results on the whole did not come up to the expectations of the inventor. In any case, the "Prelim" machine appears to be too large an unit for the average size tea factory in Ceylon.

Sulphur Corrosion.—Following reports of much accelerated acid corrosion occurring from the use of direct-fired heaters in tea factories in consequence of increases in the sulphur content of oil fuels in the middle of the year, the Technologist looked into the matter in the United Kingdom.

The application of a process developed by the British Petroleum Company may provide a cure for these difficulties and is under consideration.

To reduce the deterioration caused to roofing sheets and withering tats the following tests are now in progress in Talawakelle estate factory, with the co-operation of the Superintendent, Messrs. Aluminium Laboratories, Limited, and The Shell Company of Ceylon, Limited.

(*a*) Roofing sheets.—Specially prepared racks of different alloys are under examination. Corrugated aluminium alloy sheets are also under observation and are being compared with a galvanized sheet installed at the same time.

(*b*) Withering tats.—Jute hessian impregnated with 'Flintkote' emulsion of different concentrations is being tested for its tensile strength in comparison

with the untreated material. Parallel tests are being conducted in St. Coombs factory where a direct fired heater is not used for withering.

Taint Tests.—Flintkote and another material called 'Kling Decor' (suitable for table tops, etc.) were tested and found to be taint free.

Acknowledgements.—Valuable assistance has, as usual, been received from the tea tasters in Colombo and London, and our cordial thanks are again extended.

The Technologist also wishes to record most gratefully the assistance given by the British Council and by a number of firms and people during his tour of the United Kingdom. He was received with the utmost cordiality and to all whom he met and discussed his problems with he offers his grateful thanks.

E. L. KEEGEL,
Technologist.

REPORT OF THE PLANT PHYSIOLOGIST FOR THE YEAR 1956

General.—Dr. T. Visser (l.i. Wagenningen) arrived in May from the Netherlands and assumed charge of the Plant Physiology Department. Mr. D. H. de Saram was transferred to Neuchatel as Officer in Charge of the Low-country Clonal Proving Station and Mr. J. A. Gunasekera was appointed to fill the vacancy. Mr. F. H. Kehl was appointed Vegetative Propagation Officer.

1,332 letters were received and 1,103 despatched. Approximately 30 visits were made by the Plant Physiologist and 80 by his assistants.

Long term Field Experiments.—The following experiments were in progress during the year:—

(*a*) St. Coombs Estate—(1) The Three Factor (N.P.K.) Manurial Experiment.—The 8th cycle of this experiment finished in June 1956. The results (see Table 1) are in conformity with those for past cycles. There is a very significant response to nitrogen even at the 80 pound per acre level, inferring that significant yield responses can be also expected at considerable higher nitrogen levels.

The response to phosphate is only evident at the 30 pound level, manuring with 60 pounds leads to a decrease in yield as compared with the lower dosage. The results of this and the phosphate quality experiment suggest that the optimal nitrogen/phosphate ratio is in the neighbourhood of 2 (2 pounds N to 1 pound P). This observation more or less confirms the application of approximately the same nitrogen/phosphate ratio in the manuring mixtures as is recommended at present.

Table 1.—*St. Coombs manurial experiment. Yields for 8th cycle in pounds made tea per acre.*

Treatment	1st year			2nd year			3rd year			Total for cycle		
	Yield	Diff.	% Diff.	Yield	Diff.	% Diff.	Yield	Diff.	% Diff.	Yield	Diff.	% Diff.
NITROGEN												
N 40	512			705			533			1750		
		39	7.6		114	16.2		72	13.5		225	12.9
N 60	551			819			605			1975		
		60	10.9		146	17.8		98	16.2		304	15.4
N 80	611			965			703			2279		
PHOSPHATE												
P 0	511			784			569			1864		
		80	15.7		91	11.6		78	13.7		249	13.4
P 30	591			875			647			2113		
		–20	–3.4		–44	–5.0		–24	–3.7		–88	–4.2
P 60	571			831			623			2025		
POTASH												
K 0	478			738			555			1771		
		110	23.0		119	16.1		71	12.8		300	16.9
K 20	588			857			626			2071		
		20	3.4		37	4.3		32	5.1		89	4.3
K 40	608			894			658			2160		

During the third year from pruning the proportion of banji and flush shoots in the yield from 13 consecutive plucks was also determined. The average percentage of flush and banji calculated from these records shows that the application of a well balanced manurial mixture tends to decrease banji and increase flush. In other words, proper manuring will counteract to some extent the tendency of the shoots to become temporarily dormant.

Table 2 gives an example of the effect of manuring on the prevalence of flush and banji shoots. The table also shows that the amount of banji shoots can only be effectively decreased if all three nutrients are present.

Table 2.—*The proportion of flush and banji shoots in relation to manuring.*

Manure in pounds per acre			Flush	Banji
N	P	K	%	%
60	0	0	31.1	68.9
60	30	0	32.4	67.6
60	0	40	34.9	65.1
60	30	40	38.1	61.9
80	30	40	43.0	57.0

(2) Cultivation and Weeding Experiment.—This experiment was discontinued in August 1956, and replaced by a new fish leaf plucking experiment. The main comparisons made were between forking once and forking thrice annually, clean weeding *versus* selective weeding, and two levels of manuring (single dose and double dose).

The general effect of heavy cultivation is to depress crop slightly. Leaving out of account the first year, in the following years the average loss of crop due to heavy cultivation was no more than 4 per cent. The greatest difference was in the early stages of the experiment. There was no significant difference between the two methods of weeding employed. The results show a significant response to higher manuring.

(3) Thatching and Manuring Experiment.—This experiment is now in the third year of its second cycle. Normal estate practice, *viz.*, manuring, cultivation, weeding etc., is compared with thatching with 12 tons of Guatemala grass per acre, at intervals of six months, with no cultivation or additional manuring. The rate at which grass is applied is, where the major nutrients N, P and K are concerned, about equivalent to manuring with fertiliser. However, the latter treatment appears, from the results obtained so far, to depress the yield, as compared to the former, by about 23 per cent. This outcome is to be expected on the grounds that the greatly enhanced microflora, due to excessive application of organic matter, is likely to compete for nitrogen and minerals with the tea.

(4) New Fish Leaf Plucking Experiment.—This replaced the cultivation and weeding experiment in field No. 9. It differs from the other fish leaf plucking experiment in the respect that fish leaf plucking will be preceded by

1 year of normal (single leaf) plucking in the first year of the cycle and/or followed by ½ year of normal plucking in the last year of the cycle. The switch-over to fish leaf plucking increased the yield by about 40 per cent., however, in this case also the amount of maintenance foliage notably decreased.

(5) Phosphate Quality Experiment.—This experiment was started in 1948 in order to compare the quality of saphosphosphate and superphosphate, which were applied at three levels, *viz.*, 0, 15 and 30 pounds P_2O_5 per acre respectively. All plots received in addition 40 pounds nitrogen and 20 pounds potash per acre during the first cycle; these amounts were increased in the second cycle to 80 pounds N and 40 pounds K. The latter cycle ended in June 1956.

Table 3.—*The effect of the composition of phosphate manure on the cycle yields (4 years) expressed in pounds made tea per acre.*

Application rate	0 lb. P_2O_5	15 lb. P_2O_5	30 lb. P_2O_5
1st Cycle: Saphos	2178 (100%)	2327 (106.4%)	2408 (110.1%)
2nd Cycle: Saphos	3489 (100%)	3648 (107.6%)	3798 (111.9%)
Percentage increase in 2nd cycle	60.2	52.4	58.0
1st Cycle: Super	2178 (100%)	2427 (110.8%)	2565 (117.3%)
2nd Cycle Super	3489 (100%)	3819 (112.5%)	4112 (121.1%)
Percentage increase in 2nd cycle	60.2	57.4	60.1

Table 3 indicates that the response to saphos and superphosphate respectively has been almost the same in both cycles, while the yields obtained with super are somewhat higher than those obtained with saphosphosphate applications. None of the differences occurring in the first cycle were found to be statistically significant. In the second cycle, however, the difference in yield between 0 and 30 pounds saphos, between 0 and 30 pounds super, and between 30 pounds saphos and 30 pounds super, are significant (for $P = 0.05$). It is possible that this difference in response to saphos and super is to be explained on account of a lesser availability of P_2O_5 in saphosphosphate.

The yield increases, during the second cycle, after doubling the nitrogen and potash application, are very marked and amount to about 60 per cent. irrespective of phosphate manuring. This suggests that, so far, nitrogen and potash have been more limiting to yield than phosphate.

(6) Guatemala Grass Experiment.—The area in question was planted up in May 1951, six levels of nitrogen and two levels each of phosphate and potash were tried out. The nitrogen levels were 39, 78, 117, 156, 195 and 234 pounds per acre (N_1, N_2, N_3, N_4, N_5, N_6); phosphate levels 45 and 90 pounds per acre (P_1, P_2); potash 65 and 130 pounds per acre (K_1, K_2). The first cut was taken on 7th April 1952, and the 9th and last cut on 27th October, 1956. The results are summarised in Table 4.

Table 4.—*Response of Guatemala grass to different manuring levels, in pounds per plot* (1/40*th acre*) *for* 9 *cuts.*

Nitrogen response					Phosphate response					Potash response				
Treatment			Ave. per plot	Difference	Treatment			Avg. per plot	Difference	Treatment			Avg. per plot	Difference
N	P	K			N	P	K			N	P	K		
1	2	2	366		2	1	1	354		2	1	1	354	
				132**					85					100*
2	2	2	498		2	2	1	439		2	1	2	454	
				108*										
3	2	2	606		2	1	2	454		2	2	1	439	
				121*					44					59
4	2	2	658		2	2	2	498		2	2	2	498	
				135**										
5	2	2	727		4	1	1	485		4	1	1	485	
									31					73
6	2	2	793		4	2	1	516		4	1	2	558	
					4	1	2	558		4	2	1	516	
									100*					142**
					4	2	2	658		4	2	2	658	

Significant differences:—at 5% level* — 95 pounds.
at 1% level** — 128 pounds.

The data recorded in table 4 indicate a significant response to nitrogen at all, but one, levels. The grass also responded to both phosphate and potash at all levels of nitrogen; however, the response is not in all instances statistically significant.

Since the relationship between nitrogen application and yield of grass is almost linear, it is to be expected that even higher doses of nitrogen (more than 234 pounds per acre) would have given significant returns.

(*b*) Downside Estate, Welimada.—A 2^5 factorial experiment with no replications, consisting of 32 plots, was laid down in November 1956, in No. 10 field to test 10 treatments.

(*a*) Trenching versus no trenching.
(*b*) Deep forking in of manure versus broadcasting.
(*c*) High versus moderate manuring.
(*d*) Normal pruning versus "pre-pruning."
(*e*) Manuring twice per year versus once per year.

The lungs were "pre-pruned" (about 1/6th of each side of the bush—along the rows—taken away) at the end of November 1956. Preliminary observations show that, if this type of prune is carried out during the wet weather, extra protection against blister blight is essential in order to prevent damage to the young leaves on the side lungs. Pre-pruned bushes were found to recover somewhat quicker than normally pruned bushes.

(*c*) Passara Manurial Experiment.—This experiment completed its 8th cycle in October 1956. Due to the depressing effect of phosphate manuring on crop in the previous cycles, no phosphate was added to the plots in this cycle. There appears, however, to be a residual effect of added phosphate because all plots manured previously with phosphate, show a significantly lower yield of 14.88 pounds per plot. A possible explanation of this result may be weed competition, which was observed even in this cycle, since it was shown in the Annual Report of the Agricultural Chemist for 1948 that phosphate manuring gave rise to considerable weed growth. There is a significant increase of crop of 51.5 pounds per plot, due to nitrogen, but still no significant increase of crop due to the addition of potash.

(*d*) Endane Estate, Kahawatta—(1) Manurial Experiment.—This experiment, which is in its first cycle, was laid down to determine the proportions of nitrogen, phosphoric acid and potash to be applied to low elevation tea. It has been designed as a 3^3 factorial experiment, with each treatment replicated 6 times. During the first cycle the treatments were 80, 120 and 160 pounds nitrogen and 60, 90 and 120 pounds potash per acre per annum respectively; all plots receive a basic application of 60 pounds of phosphate per acre. So far no significant manurial effect has been observed.

Since the experimental design leaves room for the testing out of 4 manurial components, calcium and magnesium treatments may probably be introduced during the second cycle.

(2) Plucking, Manuring, Cycle Length Experiment.—This is laid out as a random block design, consisting of 12 treatments, with 6 replicates of each.

The main treatments are:—

(*a*) Plucking—single leaf plucking versus single leaf plucking for $\frac{3}{4}$ year followed by fish leaf plucking.

(*b*) Manuring—normal versus high manuring.

(*c*) Cycle length—$1\frac{1}{2}$, 2 and 3 years.

Short Term Experiments.—The following short term experiments were initiated or completed in 1956:—

(1) Dormancy Experiment.—A preliminary experiment was started on a small clonal area (T4) to observe the effect of intermittent hard plucking (to fish leaf) on dormancy, as indicated by the proportion of banji to flush shoots. A random block design, consisting of 5 treatments with four replicates of each treatment. Continuous single leaf plucking with reversion to fish leaf plucking at times when the percentage of banji shoots exceeds 20, 35 and 50 per cent. respectively is compared with continuous fish leaf plucking.

(2) Storage and Germination of Tea Pollen and Tea Seed.—Tea pollen was stored in dessicators at different relative humidities (9, 10, 25, 40, 50, 70 and 100%) at 0° to 2° C. Its viability was tested at intervals by

determining its germination percentage in 10% sucrose solution. It was found that the viability of the pollen could be maintained for at least 5 months at 40% relative humidity (optimal).

An experiment in which tea seed is stored at the same humidities and temperature as above is in progress.

The effect of damaging the seed shell and soaking of seed on germination was investigated. Preliminary results obtained under the conditions of the experiment (at approximately 18°—22° C in the laboratory were:—

(*a*) Cracking of the seeds prior to germination reduced the time taken to reach a 75 per cent. germination by approximately 2 weeks, as compared with intact seeds.

(*b*) Soaking of intact seeds for 3 to 5 days before they were cracked and laid out to germinate, reduced the time taken to reach a 75 per cent. germination by approximately 10 days.

(*c*) Between 50—90 per cent. of intact seeds which had previously been thoroughly soaked in water for 5 days cracked spontaneously when exposed for 15 minutes in the sunshine.

(3) Statistics.—Statistical analysis of experimental data was carried out to ascertain whether or not yield could be assessed by only recording intermittent pluckings. It was found that total yields over one or more years can be reliably assessed by recording the fresh weights of one in every three pluckings only. The time saved on labour involved in field experiments can be estimated to be 60 to 70 per cent. if yields are calculated in the above way instead of basing them on dry weights of all pluckings.

Vegetative Propagation—(1) Tea Selection and Vegetative Propagation.—During the year 37 new clones were planted out in test lines and cuttings of 30 new clones put out in the nursery. 43 new clones were brought into plucking early in January.

(2) Clonal Cuttings.—More than 150,000 clonal cuttings were sent to 185 estates.

(3) Growth Observations on Clones.—It was investigated whether any relationship existed between the average yield of clones and their average percentage of flush shoots per pluck (over one cycle). It appeared that a consistent relation did not exist, though the very lowest yielding clones often produce the lowest average percentage of flush shoots (relatively high in banji), whereas the very high yielding clones usually have a higher percentage of flush (relatively low in banji) per pluck.

An experiment was laid out to determine whether there was a correlation between clonal yield and the time taken for a bud to develop into a pluckable shoot. Banji and flush shoots of 21 clones having different yields were labelled and the dates of unfolding recorded. It was found that yield and growth rate are to some extent correlated. However, the relation is a "weak" one, *e.g.* flush shoots of a clone producing 500 per cent less yield than the highest yielding one took only 15 per cent longer to develop.

(4) The Effect of Shading, Watering, Soil Type Etc. on Growth of Cuttings.—Work was started on establishing a new terraced nursery in

November 1956. This nursery will be used to test out shading materials (light intensity), soil texture, soil toxicity, humidity requirements, drainage etc. on rooting and growth of cuttings.

(5) Clonal Proving Stations—Passara.—The area planted in Guatemala grass will not be ready for planting with clonal material until the end of 1957. Cuttings of over 60 clones were put out into the nursery.

Peradeniya.—58 clones were planted out in randomised rows. The planting and the randomisation were carried out by the Department of Agriculture.

Neuchatel.—A clonal proving station was established on Neuchatel Group, Neboda. In June over 60 clones were planted out in the field; cuttings of over 50 clones were put out into the nursery.

T. VISSER,
Plant Physiologist.

Addendum to Annual Report for 1955.—

(Please expand the heading of Table 13 on page 48 to read as follows :—

Table 13. *Total number of flush and banji shoots produced, above, below and at plucking level, per square inch of plucking surface in* 1 *year* (52 *plucks*).

REPORT OF THE PATHOLOGIST FOR THE YEAR 1956

General.—Mr. C. A. Loos left the service of the Institute on February 15th. Following his resignation the work of the department was conducted by Mr. J. V. Harbord until the return of the Pathologist from furlough on May 3rd.

Mr. P. A. John was promoted from the Minor Staff to the Junior Staff on 1st August.

Messrs. S. Raju and S. D. Richard were employed on a temporary basis during the conduct of the south west monsoon blister blight experiments.

679 letters were received and 686 advisory letters despatched during the year. 234 specimens of diseased material and 1,894 soil samples were examined during the year. 28 advisory visits were paid by the staff of the department and the Pathologist addressed two district Planters' Association meetings.

The recall of the Pathologist from study leave, following the resignation of Mr. Loos, resulted in curtailment of the root-flora survey which was being conducted in the United Kingdom. The fusion of the two sections of the department, without the replacement of a nematologist, doubled the amount of advisory work to be conducted by the Pathologist and resulted in the restriction of experimental work, particularly preventing the initiation of further fundamental work on phloem necrosis, wood-rot, and root-flora studies.

Blister Blight.—The south west monsoon was moderately severe, resulting in generally high levels of blister blight infection throughout most of the south western tea districts. This led to some dissatisfaction with the standard of protection obtained and many estates were led to interpose an extra round of protection between pluckings, with a consequent increase in the number of estates whose teas showed a level of residual copper approaching the permitted limits.

For a further year a series of joint field experiments were conducted in collaboration with Messrs. Fisons Pest Control Ltd. These trials are reported on individually below.

No. 6 Field Experiment.—This consisted of 14 treatments replicated 5 times. 50% "Blitox" and "unprotected" were the two control standards employed, the remainder of the treatments consisting of 12%, 4%, 1%, $\frac{1}{4}$%, 1/16% and 1/64% copper, employing normal and superfine filler at all levels. All applications were at the standard rates of 6 ounces per acre per round.

No significant difference was found between the two grades of filler. Treatments 1 and 2, (50% copper and 12% copper) were significantly better than all other treatments, although not significantly different from each other in degree of protection.

No. 2 Field Experiment.—This experiment consisted of 16 treatments replicated five times, *viz.*, control untreated, and three levels (6 ounces per acre, 3 ounces per acre and 1 ounce per acre) of the following:—50% copper "Blitox", 12% copper normal filler (N), 12% copper superfine filler (S), 4% copper (N), 4% copper (S). Again there was no significant difference between the two types of filler, and no significant difference between 50% "Blitox" at 6 ounces per acre, 50% "Blitox" at 3 ounces per acre and 12% (S) at 6 ounces per acre.

No. 3 Field Experiment.—This consisted of eleven treatments, replicated five times, *viz.*, control untreated, and 50% copper fungicide at three concentrations (0.25%, 0.125% and 0.0625%), three volumes of application (5, 15 and 30 gallons per acre) and with two droplet sizes. The only treatments which afforded satisfactory control were as follows:—6 ounces per acre in 15 gallons and in 30 gallons, with both large and small droplet sizes, and 3 ounces in 15 gallons per acre small droplet size. In general the treatments including small droplet size gave a better degree of protection than the equivalent using a large droplet size. Full analysis of these results has not yet been completed.

The results gained from the above trials may be summarised as follows.—No treatment afforded control up to the standard afforded by the normally recommended rate of 6 ounces of 50% copper fungicide per acre, but under the conditions of the experiments a degree of control falling within the arbitrary limits of "satisfactory protection", as previously defined in T.R.I. publications, was afforded by 3 ounces of a 50% copper fungicide per acre, and by 6 ounces of a 12% copper experimental fungicide, both applied on normal rounds.

No. 8 Field Long Term "Loss of Crop" Experiment.—It was pointed out in the Annual Report of the Mycologist for 1955 that the practice of manuring the unprotected area of this experiment at the level for the whole field had almost certainly detracted from the usefulness of the results. Accordingly, when the field was pruned in July, the long term trial was placed on a more rational basis. The former unprotected area was divided into two, and a similar acreage was demarcated to act as control. The trial now consists of three plots of equal size with the following treatments:—(*a*) Unprotected, manured on the basis of its own yield. (*b*) Unprotected, manured on the basis of the total field yield. (*c*) Protected, manured on the basis of the total field yield. It is hoped that this will show to what extent the loss of crop occasioned by lack of protection may be offset by over-manuring.

Wood-rot.—Results to date (Tables 1 and 2) from the two (low-country and mid-country) wood-rot experiments indicate little or no difference between treatments in the amount of die-back. Pending the establishment of some centres of wood-rot in the frames this method of assessment was chosen, as each point die-back provides a potential point of entry for wood-rot organisms. Differentiation was made between "plain" die-back, apparently unconnected with shot-hole borer galleries, and die-back associated with a typical "ring gallery" of shot-hole borer (die-back S.H.B.).

Table 1.—*Low-country results* (200 *ft. elevation*).

Treatment	Die-back S.H.B.	Die-back "plain"	Totals
1. Pruning cuts protected. Plot shaded	7	305	312 on 400 bushes
2. Pruning cuts protected. Plot unshaded	2	292	294 „ „ „
3. Pruning cuts unprotected. Plot shaded	16	240	256 „ „ „
4. Pruning cuts unprotected. Plot unshaded	14	348	362 „ „ „
Totals	39	1185	1224 on 1600 bushes

Table 2.—*Mid-country results* (3,000 *ft. elevation*).

Treatment	Die-back S.H.B.	Die-back "plain"	Totals
1. Pruning cuts protected. Plot shaded	182	23	205 on 400 bushes
2. Pruning cuts protected. Plot unshaded	139	36	175 „ „ „
3. Pruning cuts unprotected. Plot shaded	125	16	141 „ „ „
4. Pruning cuts unprotected. Plot unshaded	172	11	183 „ „ „
Totals	618	86	704 on 1600 bushes

The results indicate that, as could be expected, shot-hole borer accounts for a considerable percentage of the die-back found in the mid-country. An alarming feature is the extremely high incidence of "plain" die-back in the low-country, and investigation of the occurrence of and reasons for this die-back should merit attention.

Phloem necrosis.—The bushes in the half acre experimental block in the Kandapola district were centred to provide suitable stock branches for grafting trials during the first period of favourable weather in 1957. These trials will be initiated with material of high jat origin which is found on an

increasing number of estates to show leaf twist and necrotic spotting, possibly associated with the phloem necrosis virus.

Nematology—Selection and Proving.—The selection of apparently eelworm tolerant clones was extended to three further estates during the course of the year. A further clonal proving station was established on Diyanilakelle Estate, Lindula, bringing the total number of estates co-operating in this work to four, in line with the original plan. Progress has been rather slow, principally due to failure to establish cuttings in the nurseries of two of the co-operating estates. These difficulties have now been overcome, and within six months the full number of selected clones (167) should be established in the field, in heavily infested areas, on all four estates.

Pot Experiments.—The large scale pot experiments described in the Annual Report of the Pathologist for 1955 have been continued, and preliminary results indicate a very high rate of multiplication. Following the inoculation in March, 1955, of ten plants of each of twelve clones growing in sterile soil, examination of 100 gram. soil samples in October 1956, gave results varying from 2 to 8,633 worms per sample.

Assuming the original inoculum of 2,500 worms per pot to have been distributed amongst 10,000 grams. of soil, a population increase of 345 fold in eighteen months is indicated in the most heavily populated pot. That none of the plants in this experiment appear to be showing the least signs of debility indicates a high degree of tolerance (not resistance), possibly associated with prolific root production. Particularly low levels of population, indicating a considerable reduction in the original level, were found in clones D. 95, DE. 10/2, and T.R.I. 2135. This latter, T.R.I. 2135, also exhibited a curious phenomenon in the heavily infested clonal proving area in that repeated sampling has failed to indicate the presence of any meadow eelworm in its root system. Examination of the rhizosphere of this clone for antagonistic organisms or toxic root exudates should merit attention.

Trials with Fumigants.—The "Shell" fumigant "Nemagon" was subjected to further trials on mature tea, to estimate both a possible phytotoxic level and its effect upon eelworms within root lesions.

Applications were made at five rates to tea in plucking, *viz.* 5, 10, 20, 30 and 40 U.S. gallons per acre. Preliminary examination of meadow eelworm populations indicated an average of 45 worms per 100 gram. sample in the area treated. Sampling was conducted monthly, together with visual examination for toxicity symptoms.

On the 20th December only the 5 gallon per acre treatment was showing a residual population of 5 worms per 100 grams. soil, all other treatments being clear. No symptoms of phytotoxicity were recorded in the 5 and 10 gallon per acre treatments, but in the higher dosage rate treatments, signs of scorch and some defoliation were noted. A parallel trial, on heavily infested bushes enclosed in steel drums, was conducted at the same time, to ascertain the effects of the fumigant in a confined space. Results will not be available until at least six months after application (April 1957).

Arrangements have been completed with the Shell Co. of Ceylon Ltd., to conduct widespread trials with "Nemagon" on heavily infested areas of mature tea, during 1957.

Field Experiment.—In order to elucidate the effect of various pre-planting treatments on meadow eelworm infested soils a field trial was laid out

on an uprooted area on Dambatenne Estate, Haputale, by kind permission of the proprietors Messrs. Lipton Ltd. Four treatments have been applied, *viz.* (1) complete fallow, as far as is possible; (2) growing of Guatemala grass with incorporation of loppings; (3) heavy applications (20 tons per acre) of good pig manure compost and (4) replanting. Monthly samplings from these areas have shown to date (5 months from inception) only slight reduction in populations, and little or no difference between treatments. It is proposed to continue this trial for at least 1½ years.

A meadow eelworm sub-committee has been established to co-ordinate work on outside estates, and, to ensure continuity of the existing lines of approach to the problem.

B. N. WEBSTER,
Pathologist.

REPORT OF THE ENTOMOLOGIST FOR THE YEAR 1956

General.—Mr. G. D. Austin was appointed Entomologist on March 9th. Mr. C. Shanmugam was appointed Field Assistant to Dr. Judenko at Millawitiya, Ratnapura, and Mr. G. B. Rajapakse transferred to St. Coombs.

Between March and December 726 letters were received and 692 despatched. 174 consignments of specimens were received for examination and report. The largest consignments related to tea mites and nettle grubs. In no single year, within the last two decades, have so many insects attacking the tea plant, reached the status of pests as during 1956. The following insects and mites were thus reported on:—

Bag worms (*Ancanthopsyche subteralbata* Hampsn)	on 7	occasions
Bark-eating borer of Albizzia, (*Indarbela quadrinotata* Walk)	on 5	,,
Brown bug (*Saissetia coffeae*, Walk) ...	on 6	,,
Green bug (*Coccus viridis*, Green) ...	on 4	,,
Lygus bug (*Lygus viridanus*, Motsch) ...	on 10	,,
Nettle grub (*Natada nararia* Mo & *Thosea* spp)	on 30	,,
Purple mite (*Calacarus carinatus* Green) ...	on 3	,,
Red borer (*Zeuzera coffeae* Nietn) ...	on 5	,,
Red slug (*Eterusia cingala* Mo)	on 5	,,
Red spider (*Oligonychus coffeae* Nietn) ...	on 11	,,
Scarlet mites (*Brevipalpus* spp)	on 19	,,
Shot-hole borer (*Xyleborus fornicatus* Eich) ...	on 5	,,
Up-country tea termite (*Calotermes militaris* Desn)	on 5	,,
White grub (*Anomala* sp)	on 6	,,
Yellow mite (*Hemitarsonemus latus*) (Banks) Ewing	on 19	,,

35 estate visits, which entailed close on a hundred inspections, were made and four district Planters' Association meetings attended and addresses delivered at them. Assistance was also given to the Sabaragamuwa Planters' Association in connection with the arrangements for the Shot-hole borer Symposium at Ratnapura in September.

The insectary and entomological equipment at the Passara Sub-Station were shifted to St. Coombs in April.

Nettle Grub.—This caterpillar pest has in recent years been associated with the province of Uva. During the year under review, the pest, mainly of

the species *Natada nararia*, was reported to cause extensive defoliation both in the Central Province and Uva. The outbreaks in the Central Province did not last more than a couple of months, being brought under control by natural agencies like "wilt" disease and the hymenopterous parasites, *Fornicia ceylonica* (Braconidae) and *Neoplectrus maculatus* and *Platyplectrus natadae* (Euplectrini). No estate was obliged to adopt any artificial measure of control. In Uva, however, a majority of the reported outbreaks persisted for several months. A couple of large groups of estates reported that spraying campaigns with D.D.T., soap solutions, etc., had all failed to effect control. The situation necessitated the concentrated attention of the Entomologist.

It is well known that applications of modern insecticides sometimes result in either more serious outbreaks of the pest it is intended to control or the appearance of some other pest in larger numbers than observed previously. Local examples are the outbreaks of tea tortrix following applications of Aldrin, Dieldrin and "Intox 8" (Chlordane) against shot-hole borer, and that of red spider following spraying or dusting with D.D.T. for the control of Helopeltis. No untoward outbreaks of red spider or any other mites were observed in fields sprayed with D.D.T., on six estates in Uva, for the control of nettle grub.

One estate reported, however, that a field which had received two applications of D.D.T., within one month in 1955, had subsequently developed a severe outbreak of red spider (*Oligonychus coffeae* Nietn). A spray of the non-tainting acaricide "Akar" was effective in ridding the field of the mite. On subsequent occasions Akar was incorporated with the D.D.T. sprays and no further outbreaks of red spider noticed.

Sabaragamuwa too reported a couple of outbreaks of nettle grub. Five species were involved, the dominant being *Thosea recta*, Hampsn, originally known as the "Morawak Korale" nettle grub. Three outbreaks of this pest occurred on one large estate. The first attack almost passed unnoticed; the second caused a certain amount of defoliation. Since natural enemies like hymenopterous parasites and "wilt" disease were conspicuous by their absence, the estate was requested to spray with soap solutions, which the Superintendent acknowledged gave very good control. The opportunity was taken by the entomological staff, stationed at Ratnapura at that time, to test the efficacy of "Teepol", as a substitute for soap solutions, and Endrin E.C. as a spray for the control of *Thosea recta*. A 1% solution of Teepol was found to be as effective as soap in the dilution of one pound in 10 to 20 gallons water. This is a more concentrated solution than the one found effective against *Natada*. Endrin at the dosage of 1 pint in 15 gallons gave the highest mortality. No resurgences of *Thosea recta* or *Homona coffearia* (tea tortrix) were observed in the area treated with this chlorinated hydrocarbon. A third outbreak occurred in the areas untreated on the previous occasion. But when an examination of the field was made, at the stage when the larvae were about half grown, it was observed that, though hymenopterous parasites were still absent, a "wilt" disease was manifesting itself which eventually wiped out the pest. No further outbreaks were recorded up to the end of 1956.

The remaining 4 species recorded in Sabaragamuwa were: *Parasa lepida* Cram (blue-striped nettle grub), *Natada nararia* Mo, (fringed nettle grub), *Narosa conspersa* Wlk, a small gelatine grub, *Belippa laleana* Mo, a larger species of gelatine grub.

Mites.—These continued to receive a considerable amount of attention. An acaricidal trial against scarlet mite was laid down in field No. 9 on St. Coombs early in 1956. Its object was to compare the relative effectiveness of

sulphur applications as "Spersul", given as heavy post pruning sprays, with light applications of a non-tainting acaricide (Akar) incorporated with routine copper fungicidal sprays. Six blocks of tea comprising 3 plots of a hundred bushes each were utilized for the trial. Estimates of mite populations were to be made at regular intervals through the cycle and crop yields were to be recorded to determine any loss of crop due to mite attack. Unfortunately the experiment had to be abandoned due to the heavy frost damage experienced early in the year. The experiment is, however, being repeated in field No. 13, pruned in June, 1956.

Up to December, 1956, the plots had received 4 applications of sulphur and 23 of Akar. Four estimates of mite populations were recorded. Nothing untoward has occurred so far. The experiment will be continued till the field is next pruned, *i.e.* in 1960. Mr. Ranaweera the Senior Entomological Assistant is in charge of this experiment and all other trials with acaricides.

Acaricidal Trials and Yellow Mite.—Preliminary trials with "Ekatine", "Aramite G. 2934" and Teepol, at recommended concentrations, did not give satisfactory results at St. Coombs. As the continuous rainy weather, which prevailed during the period of trial, may have mitigated against the efficacy of the sprays, it is proposed to carry out a more comprehensive trial in Uva some time in 1957.

Mites and Copper Sprays.—With a view to ascertaining the connection, if any, between applications of copper and outbreaks of mites, the compilation of a list of estates, which had hitherto not resorted to spraying or dusting for the control of blister blight, was started. A technique to be adopted when inspecting such estates has been drawn up.

A search for bushes manifesting resistance to mites is being maintained. Planting material from such bushes will be tried out at the Institute's clonal stations.

A comprehensive article on scarlet mites and measures recommended for their control by Dr. Baptiste and Mr. Ranaweera was published in the *Tea Quarterly*, Vol. 26, Part 4, December 1955.

An article on "Observations on mite attacks in Haputale" by Mr. C. N. J. Mulrenan of Gonamotava Estate will be published in the first part of Volume 28 of the *Tea Quarterly*.

A small consultative committee, consisting of Mr. Peter Wright of Brunswick, Maskeliya, Mr. C. W. Bond of Laxapana, Maskeliya, Mr. C. N. J. Mulrenan of Gonamotava, Haputale, the Entomologist and the Senior Assistant, was appointed towards the end of 1956, in connection with the study of tea mites.

Shot-hole Borer (**Xyleborus fornicatus**).—Intensive investigations into this pest were continued at Millawitiya Estate, Ratnapura, by Dr. Judenko, the special Research Entomologist in charge. This work is reported on separately by Dr. Judenko.

A line of research not pursued systematically hitherto was the search for bushes or clones resistant to shot-hole borer. This aspect of the investigation was therefore commenced in 1955 when the Assistant Entomologist was stationed in Sabaragamuwa. 18 clones on six estates are now under observations as follows:—6 in Kahawatta, 3 in Ratnapura, 3 close to Ginigathena, 3 in the Deniyaya area, and 3 in Uda Pussellawa. These clones were selected

originally because they were high yielders and good rooters and gave indications of acceptable manufacturing qualities and resistance to blister blight. Evidence of resistance to shot-hole borer was only observed when the bushes were pruned. Observations are recorded at periodical intervals with a view to ascertaining whether the indications of resistance are only apparent at the end of a cycle (2 to 3 years) or whether these symptoms are inherent in the bush right through the cycle. Once this information is ascertained- promising clones will be multiplied at our three clonal stations at Kalutara, Passara and Morawak Korale. They will also be tried out in other localities where shot-hole borer is rampant.

Shot-hole borer was the subject of a symposium held at Ratnapura in September under the auspices of the Sabaragamuwa Planters' Association in collaboration with the Tea Research Institute. The meeting was well attended by delegates from the planting districts, Colombo Agency Houses and technical representatives of insecticidal and manurial firms interested in the problem of shot-hole borer control. Papers were read by members of the Tea Research Institute staff and the chief delegates from three planting districts. Proceedings were published in the *Tea Quarterly* Vol. 27, part 4, December, 1956.

Calotermes militaris.—This is the up-country tea termite which is reputed to feed on living tea. According to Jepson, of the Ceylon Department of Agriculture, who investigated the whole termite problem between 1925 and 1935, "the chief scene of its activity is the Maskeliya district, where it is extremely destructive on a large number of estates," and "a bush attacked in this way is doomed and cannot be rebuilt. It is only a matter of time before it dies." (*Tropical Agriculturist* Vol. 67, No. 2, pages 67—79, August 1926).

The only measure recommended in those days for the control of *militaris*, apart from the complete removal and destruction of an affected bush, was the injection of Paris Green into the frame of the bush. With the ban on the use of all arsenical insecticides, both in tea fields and factories, estates have been on the look out for a substitute for Paris Green. The Superintendent of Moray Estate, Maskeliya, found a dilution of "Intox 8" rather effective when the chemical was poured into cavities made by the termites. He desired the Institute to investigate the method further. The "pouring method" was improved on by forcing the termiticide into the frame of the bush (at pruning) with the aid of a knapsack sprayer. The technique adopted on Talawakelle Estate, where a trial was carried out in 1956, was to inject the spray into the cavities of the frame, 2 to 4 pints being administered to each bush through a nozzle (without the internal disc) of a pressure retaining knapsack sprayer.

The following insecticides were tested:—"Dieldrex 15", "Intox 8", and "Malatox." Applications were made only once. Though bushes were labelled to facilitate examination at a later date, some of the labels disappeared and consequently only 57 bushes were examined. Toxicity was determined by uprooting both treated and untreated bushes and estimating percentage mortality among the termites within the bush. Three examinations were made at approximately 3, 6 and 21 weeks after application.

The results were not discouraging as a hundred per cent. mortality was obtained from the treatments as follows:—

"Intox 8"	in	76% of the bushes treated
"Dieldrex 15"	in	68% of the ,, ,,
"Malatox"	in	21% of the ,, ,,

But the question now raised is whether the damage caused by *C. militaris* warrants the expense of insecticidal treatment in view of the findings of Redman King, the Institute's Entomologist, 20 years ago. King had 27,962 bushes dug up and thoroughly examined in the Maskeliya district, and in a field said to be the worst affected with *militaris*, he found that less than 5 per cent. of the bushes contained living termites, while just over 12 per cent. of the bushes were abandoned by the termites and still flushing! His conclusions were that *C. militaris* cannot be said to be extremely destructive and that a bush which is attacked cannot be said to be doomed. No bush examined had been killed or was in a moribund condition through the agency of termites (*Tea Quarterly* Vol. 10, Pt. 4, pp. 195—206, 1937). It is accordingly proposed to investigate the termite problem in 1957, both up-country and in the low-country.

Lygus bug.—The distribution of this capsid is now much wider than that recorded during the last few years. Our knowledge of its bionomics too is meagre. Nothing has been added to what Webster published in the *Tea Quarterly*, Vol. 25, Pt. 1, page 18, 1954. He attributed the symptoms of "corroded flush" to be due to the punctures caused by *Lygus viridanus* Motsch and not to Cercosporella disease as hitherto accepted. This is another entomological problem awaiting elucidation in 1957.

Miscellaneous.—An annotated bibliography of all published papers relating to the shot-hole borer of tea (*Xyleborus fornicatus* Eich) was completed during the year, and should appear as a bulletin sometime in 1957.

An author index of all published papers relating to the insects and mites attacking tea is in course of compilation. This index should be completed in 1957.

A combined author and subject index of all articles published in the *Tea Quarterly* up to volume 23 was completed a couple of years back. It is hoped to bring this index up to date concluding with volume 28.

G. D. AUSTIN,
Entomologist.

REPORT OF THE ENTOMOLOGIST, SPECIAL RESEARCH, FOR THE YEAR 1956

General.—The work of the Entomologist, Special Research, who was seconded to the Tea Research Institute from Messrs. Fisons Pest Control Ltd., in 1955, is confined solely to the shot-hole borer problem, and is centered on a laboratory established on Millawitiya Estate near Ratnapura. The work carried out during the year was mainly concerned with further investigations into the biology and habits of the pest. Research on shot-hole borer first started in 1898 and much valuable work had been done up to 1955, but many details regarding the life-history of the pest still remained unknown. This is probably one of the reasons why it has not as yet been found possible to make any practical recommendations for the control of the pest.

Identification of Shot-hole borer.—There appeared to be some disagreement between entomologists as to the correct identification of the pest. Accordingly, nearly 3,000 beetles, dissected out of pruned branches collected from 4 estates in the low-country, were sent to Professor Dr. K. E. Schedle, a Senior Entomologist of the Federal Forest Research Institute of Austria, for determination. All except two specimens, were found to be *Xyleborus fornicatus* Eichoff.

Reproduction of Shot-hole borer.—There are some indications that the pest can multiply parthogenetically. The economic importance of insects which reproduce in this manner is usually greater than is the case with those which reproduce normally. Accordingly, arrangements have been made for the method of reproduction of the beetles to be studied by Dr. B. E. Wolf of the Institute of Genetics, Berlin University.

Appearance of beetles outside galleries on tea bushes.—Observations have shown that beetles are found on both the lower and middle parts of tea bushes. Further experiments are being carried out to investigate the number of beetles walking on the lower parts of the bushes with a view to determining the feasibility of spraying with contact insecticides on the lower parts of the bushes only, especially on young bushes. This type of spraying would largely eliminate any danger of chemical poisoning of the harvested crop and, at least partially, destroying beneficial insects.

Only females bore galleries and it was found out in a laboratory experiment that the females are able to walk from bush to bush along adjoining branches. Distribution of the pest would thus appear to be facilitated by closer spacing between bushes. This finding is particularly relevant in connection with new clearings in which the plants are now commonly planted much closer together than is the case with old tea.

Movements of females out of tea bushes.—Field experiments have shown that females are able to fly at heights from 6 inches to 14 feet above ground level. They are also able to walk on the soil surface for distances up

to about 40 feet. These results indicate that females can easily reach new clearings by either flying or walking from adjoining old fields which are infested with the pest.

Beetles inside prunings.—Laboratory experiments have shown that females, which have emerged from prunings, are able to infest tea bushes and produce progeny in the galleries.

Dry conditions cause more rapid emergence of beetles from prunings than wet ones. The more rapid the emergence the higher is the mortality of the beetles soon after emergence.

An experiment carried out in sunny weather in April with prunings cut into 4 inch lengths and spread in one layer, either between rows of pruned bushes or in the open, showed that almost all the beetles died inside the galleries. In a similar experiment in August, however, only a small number of beetles died inside the prunings. Live beetles were still found in the galleries after 7 weeks.

Trials with a method of assessment of infestation on old tea.—The following method was under investigation. A piece of live branch, 4 inches long, 6/16 inches in diameter at the base and top, and free of any secondary branch or green shoot was taken as a standard unit. 50 such units were taken at random from each of 21 different fields, situated from near sea level up to 6,000 feet elevation, and the number of galleries per 50 standard units counted and used as a measure of the degree of infestation.

It appeared during these trial assessments that fields situated above 4,000 feet were either not infested or infested to a very small degree only while fields situated below 1,000 feet were seldom infested to a high degree. The highest infestation was found in those fields situated between 2,000—3,000 feet elevation.

E. JUDENKO,
Entomologist, Special Research.

REPORT OF THE LOW-COUNTRY SCIENTIFIC OFFICER FOR THE PERIOD JANUARY—AUGUST, 1956

General.—There were two staff changes in the low-country during the period under review. Mr. G. D. Austin (previously Assistant Entomologist, working mainly on the shot-hole borer problem) was transferred to the Tea Research Institute at St. Coombs, on his promotion to the post of Entomologist. Mr. D. H. de Saram was transferred from St. Coombs to take charge of the new clonal proving station on Neuchatel Estate; the co-operation of the Neuchatel management in making a bungalow available for him is gratefully acknowledged.

205 letters were received at this station and 216 letters were despatched during the period under review.

16 advisory visits were made to estates, and 3 Planters' Association meetings were attended and addresses given at 2 of these meetings.

Our thanks are again due to the management of Vogan, Ingiriya, Galbodde, Endane, Mahawale, Millawitiya and Korahilagoda estates for continuing to allow us facilities for field experiments on these estates. Similarly, to the management of Neuchatel Estate for leasing 25 acres of land to us, for use as a clonal proving trial area.

Vegetative Propagation Experiments.—NEUCHATEL ESTATE.—The lease of a 25 acre block on Neuchatel estate for a clonal proving station was not finally completed; nevertheless, since both parties to the lease had given their approval in principle, it was decided to make a start with the opening up of this land.

About 4 acres (previously under old rubber) were cleared and fenced, ready for planting in the south west monsoon; approximately 2 acres of this were planted up with clonal material, consisting of 6,400 well grown basket plants of 62 clones transported from our nursery on Vogan estate.

The exceptionally flat lie of this land, and its almost complete freedom from rocks, render it ideal for our somewhat exacting requirements. Thus every single row has exactly the same number of plants and growth conditions in each row are identical, so that really precise comparisons between the various clones can be made. In practice, rows of 15 and 30 plants respectively were found to be best suited to the general layout, with paths dividing the blocks.

Clonal seed from Ederapolla has been used along the boundaries of every block, so as to ensure uniform competition between all clonal rows; several rows of clonal seed have also been included for yield comparison purposes.

Vogan Estate.—The plants in the 1955 new clearing stood up very well to the severe drought which was experienced during the first few months of the year. This experience—which is confirmed on other low-country estates, both in new clearings and well established clonal plots—should be adequate to dispel the doubts widely held at one time concerning the inherent ability of selected clones to withstand prolonged drought.

Further collections were made of selected outstanding clones from several estates—amongst which was at least one believed to be highly resistant to shot-hole borer.

Miscellaneous Observations.—(1) An entirely new variation of pruning technique was developed by the Superintendent of Maliboda Group, and reported on by me. In essence this consists of a modification of the normal rim-lung prune, the main points of difference being as follows:—

(*a*) the branches which form the "lungs" are cut 2 months before the main prune (thus reversing the normal procedure).

(*b*) the branches along the sides of the bushes are cut, so that two continuous lines of such branches are formed (conforming to the rows); in effect these become "side-lungs."

Suffice it to say that at the present early stage this new technique shows very great promise.

(2) Observations were continued on shot-hole borer with special reference to shortened pruning cycle lengths. These observations continued to support all the preliminary data so far collected. The following is a brief summary of some of these observations:—

(*a*) A careful examination was made of the yields of an estate which was seriously affected by shot-hole borer during the dry weather months of January—March, 1955 and 1956. On this estate two different cycle lengths are adopted, *viz.* 18 months and 2 years, so a comparison between the loss of crop during the first and second dry weather periods of these two cycle lengths can easily be made. The results of this comparison are as follows:—

2 *year cycle fields.*—There is a very marked decline in yields during the dry weather months of the second year in the cycle; in some cases this decline (on the basis of the comparison I have given) amounts to as much as 150 pounds per acre. The overall yields during the second dry weather period in the cycle are only 65 per cent. of those during the previous dry weather, indicating a loss of crop of 35 per cent.

18 *month cycle fields.*—There is no much marked difference between the yields of the first and second dry weather periods in the cycle; in no case is the decline more than 30 pounds per acre during the second dry weather period and in several cases there are actually increases during this period. An overall loss in crop of only 3 per cent. is recorded during the second dry weather period.

(*b*) On another seriously affected estate, fields pruned in late 1955 on an 18 month cycle showed negligible damage from shot-hole borer; on the other hand damage was in evidence on the fields left over till

April/May 1956, (at which stage they had run 21—22 months). On the same estate, the fields which have recently gone over to an 18 month cycle show—after 8 months—an increase in yield of 17 per cent. over those obtained at the corresponding stage in the previous cycle.

(*c*) In my report for 1955 reference was made to unusual chlorosis symptoms which developed on a 1950 new clearing after the second tipping. This field had suffered a severe attack of shot-hole borer in the 14th month and had then been pruned at 18" without the normal precaution of leaving rim-lungs. The progress made by this field was closely watched, and shortly after it recovered from the chlorosis symptoms it suffered another severe set-back from shot-hole borer which necessitated another prune.

The inference I draw from this is not that a shortened cycle length is in any way unsound, but that it is all the more essential to adopt recognised pruning methods in these conditions. Similarly, in other cases, where a severe attack of shot-hole borer was developed within a few months of pruning, the primary reason for the return of the attack is believed to be the faulty pruning technique adopted.

T. E. WALTER,
Low-country Scientific Officer.

REPORT OF THE SCIENTIFIC ADVISER, LOW-COUNTRY, FOR THE PERIOD SEPT. 15th—DEC. 31st 1956

General.—Mr. T. E. Walter resigned his post as Low-country Scientific Officer and left Ceylon on 16th August. On 16th September I assumed duties as Scientific Adviser, Low-country, "to report on the organisation of a low-country sub-station," and if this report is accepted by the Board, "to supervise the establishment of the station and train an understudy," and also "to carry out such cognate work as the Board and Director may require." The latter comprised the supervision of the experimental work in the low-country coming under the direct control of the Adviser and the continuance of the advisory work carried out by my predecessor.

After attending the shot-hole borer symposium at Ratnapura, two weeks were spent at St. Coombs to study the latest developments in tea research and to discuss with the Director and Research Officers the experimental work being carried out in the low-country and the lines of my future programme of work.

220 letters were written and 40 visits to estates made during the period under review. The latter were for the purpose of familiarising myself with existing practices in tea cultivation in the low-country and to supervise the experimental work in hand.

3 District Planters' Association meetings were attended and addresses given on my work. I have to express my sincere thanks to many members of the planting community in the low-country for their active co-operation in the discharge of the duties of my assignment, and to the management of the estates on which our experimental work is conducted for the facilities they provided us so readily.

Field Experiments.—(1) Vegetative Propagation Trials.—With the establishment of the clonal proving station at Neuchatel all planting material had been transferred to this station from Vogan, and a decision was thereafter taken to close the latter. The new station was transferred to the administrative and technical control of the Vegetative Propagation Officer, St. Coombs, early in August. Two acres have already been put under clonal material and over 50 selected low and up-country clones have been laid down in the nursery and 60 in multiplication plots.

(2) Pruning Cycle cum Shot-hole Borer Experiment, Ingiriya Estate.—This trial was continued on lines previously adopted with minor modifications in experimental technique. The adjusted yield figures from the start of the trial in June, 1952, to the beginning of January, 1957, when the 1½ year cycle plots were pruned for the third time, are shown in Table 1.

Table 1. *Ingiriya pruning cycle experiment. Yields at 4½ years.*

Treatments	Cycle (years)	Total yield (Lbs. per acre)	Total yield (%)	Total yield Increase over B (Lbs. per acre)	Annual increase over B (Lbs. per acre)
A	1½	5524	124	1057	235
B	2	4467	100	—	—
C	2½	4725	106	258	57
D	3	5126	115	659	146

These figures confirm earlier findings that the 1½ year cycle gives the highest annual yield per acre, while the 3 year cycle is a good second. The average annual yield increases per acre over the 2 year cycle are 235 pounds (24 per cent.) and 146 pounds (15 per cent.) for the 1½ and 3 year cycles respectively.

An assessment of shot-hole borer infestation made in November by Dr. E. Judenko, Special Entomologist for shot-hole borer, by his new unit method revealed that the incidence of the pest in the experimental area was low. There were no apparent effects on crop yield of treatments with Dieldrex against shot-hole borer.

(3) Shade Experiments, Galbodde Estate.—This trial had not made any material progress, though two or three attempts had been made to establish the required shade species. It is proposed to abandon the "qualitative" trial on the 20 acres of old tea and to restrict any experiment on shade, if it is decided to proceed with it at Galbodde, to the 10½ acres of young tea. The design of the trial is being reconsidered.

(4) Other Experimental Work.—The results of experiments carried out by the specialist officers in the low-country will be found in the reports of these officers. The items of investigational interest are:—clonal trials at the Neuchatel proving station by the Vegetative Propagation Officer, shot-hole borer investigations by Dr. E. Judenko, manuring experiments by the Plant Physiologist and Agricultural Chemist, and wood-rot investigations by the Plant Pathologist. Two new trials were started at the end of the year on systems of bringing young tea into bearing and on pruning techniques in relation to yield and disease incidence.

Miscellaneous.—Chlorosis of Tea.—A study is being made in collaboration with the Agricultural Chemist of the problem of chlorosis in the low-country. An acute case of induced chlorosis, noted at tipping, on the older leaves of rim lungs left at pruning, is under close observation. A notable improvement in the condition of the bushes was observed three months later, but the symptoms re-appeared during the dry weather. A trial is to be laid down on a sandy field of an estate in the Southern Province where chlorosis is markedly prevalent, to ascertain the effects of high levels of potash and magnesium singly and in combination with the minor elements zinc and copper, and with and without bulky organic matter. Attention will also be given to other types of chlorosis found in the zone.

Magnesium and Potash Deficiencies.—Magnesium deficiency occurs with more than rare frequency in the low-country and it is pleasing to record that endeavours to promote the application of dolomite limestone, where the pH conditions are satisfactory, have met with very encouraging response. It is also gratifying to state that the basic recommendations of the Institute on tea manuring are being adopted by most estates. A number have, however, modified the standard T. 500 mixture to provide a higher proportion of potash, with beneficial results apparently. In a few instances striking responses have been reported, though how much of these are due to potash *per se*, it is difficult to say. The Endane manurial trials, in which potash is being tested out in liberal doses, will throw light on this interesting and important problem in the low-country.

Vegetative Propagation.—There is a widespread interest in vegetative propagation in the low-country and many estates have initiated a programme of V.P. selection and multiplication work with a view, at least, to filling vacancies with V.P. material. On one estate in the Yatiyantota district over 100 acres have been planted out with clonal material. There would appear to be good reason for holding short training classes in V.P. work for young assistant superintendents who would be primarily concerned with this activity.

New Clearings.—The necessity for adopting less drastic methods than centering for bringing young tea into bearing in the low-country, *viz.* by bending, layering and thumb-nail pruning, is becoming more widely appreciated in the low-country. The excellent results following the adoption of "thumb-nailing" on an estate in the Deniyaya district, where 5 year old tea was giving about 2,000 lbs. per acre, are worthy of emulation.

Pruning Systems and Cycles.—The new method of reverse rim-lung pruning developed by the Superintendent of Maliboda Group, has created much interest in planting circles in the low-country. The technique is being tried out on a large field scale, and to judge by the appearance and vigour of the bushes and the absence of die-back in the centre, is likely to prove very beneficial. A trial has been started to determine the feasibility of adopting this system of pruning in the low-country during dry weather, and the results will be watched with more than usual interest.

On the question of the duration of pruning cycles in the low-country, it has to be stated that while the 2 year cycle is the one most commonly adopted, some estates are already adopting what is known as the "18 month" pruning cycle where rainfall conditions are satisfactory. In reality, however, the period varies from about 16 to 21 months, and can be more appropriately designated the "north-east, south-west" or "spring-autumn" pruning cycle. Mention should also be made of the observation that, where shot-hole borer incidence is low, the pruning cycle can be extended to 3 years without adverse effect on crop yield or condition of bush. This has been demonstrated on a few estates in the Galle and Kalutara districts which have adopted the 3 year cycle, in one case for over 10 years. The third year yields are nearly as high, if not higher than those of the second year.

Maintenance Leaf-fall.—The problem of maintenance leaf-fall is observed on a number of estates in the low-country after about the 18th month of the pruning cycle in association with "horse hair" and other blights and, in a few cases, shot-hole borer. A number of physiological and agronomic factors, among other methods of pruning, bush sanitation, nutritional deficiencies, poor soil conditions accentuated by drought, inadequate light, etc., together with pathological factors like fungal diseases (*Corticium* spp.),

red rush (*Cephaleuros parasiticus*), and shot-hole borer attack, are associated with the condition. Further attempts to prevent this leaf-fall, once thought to be due to *Rhizoctonia*, will be made on an area of high yielding tea at Ingiriya.

Shade in Low-Country Tea.—There are few matters connected with tea in the low-country on which there is such a diversity of opinion and practice as that of shade. The species commonly grown are *Albizzia moluccana* for high shade, and *Gliricidia maculata* (*sepium*) and *Albizzia moluccana* (lopped) for low and medium shade respectively. Much variation exists in respect of the density of planting and relative proportions of the two species. On some estates Gliricidias or Albizzias are planted out for both medium shade and green manure supply. On others, Albizzias suitably trimmed are grown solely to furnish a high, light, feathery shade, while the bulky organic matter is supplied by Gliricidias planted out in the intervening rows. Shade experiments are therefore very essential, but there is no easy method of assessing the effects of shade *per se* and of eliminating the manurial value of the loppings. To be effective these experiments, which are by necessity of a long range nature, should be carried out under conditions where land is not a limiting factor and where continuity of tenancy and policy are assured.

A. W. R. JOACHIM,
Adviser, Low-country Tea Research.

REPORT OF THE MAINTENANCE ENGINEER FOR THE YEAR 1956

General.—With a large building programme in prospect and very poor availability of stone on St. Coombs, it was considered most essential to accumulate a stock of rubble before building started. A new quarry was accordingly opened up for use by outside rubble contractors. As a consequence a stock pile of some 600 cubes of rubble was available by the time the main building operations began in October.

The maintenance and repair of all machinery, equipment and vehicles was carried out in the workshop and motor garage, which between them completed some 889 jobs.

Further improvements in the layout and general appearance of the Institute surrounds were effected during the year.

Buildings.—(1) Maintenance.—The remaining interior work under the special maintenance vote, which involved the improvement of bathrooms, kitchens and pantries in the existing staff quarters, was carried out.

The main laboratory and office building was repainted externally and the walls treated with "Snowcem."

New individual septic tanks were constructed and new sewerage lines laid as necessary to serve six junior staff quarters.

(2) Extensions.—The Works' Clerk's, Electrician's and Telephone Operators' quarters were extended as necessary to bring the accommodation up to standard. Certain necessary extensions were also made to some of the existing minor staff quarters.

Work was commenced on the building of a new wing for the Guest House. When completed this will provide three new bedrooms with individual bathrooms. The design for this additional wing was drawn up by the Institute's Architects in conformity with the style of the existing building.

(3) New Senior and Junior Staff Quarters.—The Board having approved the construction of 4 new senior and 2 new junior staff quarters the services of a D4 tractor were obtained to cut and level the new sites, which operation involved the moving of a great quantity of earth. The contract for the new buildings, the plants of which had been prepared by the Institute's Architects, was put out to tender and construction work under the successful tenderers, Messrs. M. Y. Hemachandra & Co., Ltd., was well under way by the end of December. However, in view of the rise in the cost of materials occasioned by the Suez crisis it was finally decided to proceed with the construction of only 3 senior staff quarters instead of the 4 originally approved.

(4) Other New Works.—The construction of 3 new double blocks of minor staff quarters and 1 new double block of servants' quarters, which had been included in the 1956 estimates, was in progress.

A large nursery shed, adjoining the main laboratory approach road, was constructed for the Physiology Department.

Roads and Bridges.—The remainder of the main access road was widened and re-metalled. Where required portions of the earth drains along this road were paved with rubble in cement mortar. A new reinforced concrete bridge was constructed across the stream running out of the factory area and the level of the main road raised.

Access to the minor staff quarters was improved by constructing a new reinforced concrete bridge in place of the old wooden foot-bridge. The existing road was also widened and made motorable.

A new motorable road was constructed from the caddy to the Club House.

Further lengths of the St. Coombs estate and ¾ mile of the Kowlahena roads were remetalled.

Whilst the D4 tractor was at St. Coombs use was made of it to level approximately ½ mile of access roads leading to the new senior and junior staff quarters.

Factory Equipment.—An automatic belt feed conveyor for the C.C.C. rotary roll-breaker was designed and constructed. Counter balance weights and special door release mechanisms were designed and fitted to the two double action rollers and to one of the single action rollers.

Routine maintenance and repairs of all factory machinery and equipment was carried out as necessary.

Electrical.—Three staff bungalows were entirely rewired. Rewiring was also carried out in the laboratory, office and library and fluorescent lighting installed. Similar improved lighting was also installed in the factory firing room.

A new A.C. overhead transmission line, with connections to the telephone exchange, estate K.P's and assistant clerk's quarters, was installed. Seven new street lights were also installed along the main road.

Water Supply.—The contract for the new concrete dam, which will be approximately 156 feet long and 26 feet in height, was let to Messrs. Brown & Co., Ltd. By the end of the year the excavation work had been carried out and concreting was under way. When completed the new dam will provide storage capacity for over 8 million gallons of water.

D. V. W. PERERA,
Maintenance Engineer.

REPORT OF THE OFFICER-IN-CHARGE SMALL HOLDINGS ADVISORY SERVICE FOR THE YEAR 1956

General.—Vacancies created by the resignation of two tea instructors and one clerk were filled during the year. An additional tea instructor was also recruited to cope with the increasing requests for advice from small holders and tea co-operative societies.

11,473 letters were received and 14,869 despatched.

Advisory.—13,212 visits to small holdings were made in connection with advisory work. Assistance has also been given to the Land Commissioner in selecting and developing suitable land for tea cultivation under the Government highland colonization schemes in Ratnapura, Morawaka and Badulla.

New Planting.—The prolonged drought during the year caused considerable damage to the tea. All agricultural operations, including new planting, were interrupted to a considerable extent. There was also a scarcity of tea seed, resulting in very little planting being possible during the south west monsoon, which is normally the best planting season.

198¾ maunds of tea seed were supplied to small holders and to tea co-operative societies.

Tea Control Work.—Officers have also been called upon to do tea control work in addition to their normal duties. 822 visits were made in connection with the registering of tea holdings, issuing of permits for new planting, etc.

Propaganda.—(1) Demonstration Plots.—There are 254 demonstration plots in the different provinces maintained by keen small holders, who have been issued with free manure and tea seed as an encouragement. Several of these demonstration plots have been visited by interested small holders and the methods adopted on them are being followed.

(2) Exhibitions.—The Small Holdings Advisory Service participated with the other departments of the Tea Research Institute in organizing the tea section at the Royal Agricultural and Food Exhibition which was held at the Ceylon Turf Club grounds in Colombo.

Several propaganda meetings and film shows were also organised in connection with the National Soil Conservation week. Many of these shows were a great success and served a very useful purpose.

(3) Film Shows.—Propaganda meetings followed by film shows were held in the Central province, Sabaragamuwa province, Uva province and Southern province. In all some 85 film shows were given. The films were kindly loaned by the Government Information Department and the United Kingdom and United States Embassies.

(4) PHOTOGRAPHIC WORK.—In order to carry out propaganda work more effectively a photographic studio was fitted up at the end of the year. It should now be possible to produce all the film-strips necessary for visual aid training. 458 holdings, where good agricultural practices had been adopted, were photographed. From these photographs slides and film strips were produced and used at propaganda meetings.

Conference.—The Officer-in-charge contributed a paper on shot-hole borer on tea small holdings at the symposium held at Ratnapura on 14th September, 1956.

Vegetative Propagation Competitions.—A competition in vegetative propagation was started in the Kotmale district during the year in order to popularise this advanced method of tea propagation among small holders. Mr. P. S. Gray of Sheen Estate, Pundaluoya, whose idea it was to start this competition, offered a cash prize of Rs. 100/- to be distributed among the three best owners of V.P. nurseries in the Kotmale area. The response was very satisfactory.

Co-operative Societies.—At the end of December, 1956, there were 24 tea small holders' co-operative societies with a total membership of 3,965, covering an acreage of 15,301 acres. Rs. 281,590/- has been collected as share capital.

The main object of these tea co-operative societies is to own their own manufacturing centres and eliminate the middleman and the bought-leaf factory owner and to ensure a fair price to the producer, who has hitherto never been able to obtain a fair price for his produce. One of these societies has its own factory and five other societies have made their own manufacturing arrangements. Attention has been concentrated on improving the standard of plucking and as a result considerable improvement has been noticed, especially, in areas where societies have undertaken manufacture. The members of these societies have been able to obtain a good price for their green leaf by undertaking their own manufacture and resorting to fine plucking.

Directors of the English and Scottish Joint Co-operative Wholesale Society Limited, who were in Ceylon on a visit to their estates, visited the Uda Palata Tea Producers' Co-operative Society to see the progress made in the scheme of manufacture which is being done in one of their factories. They were very satisfied with the progress made.

Acknowledgements.—The continued help and co-operation received from the Government Information Department, and the United Kingdom and United States Embassies in connection with the supply of films is gratefully acknowledged.

R. L. ILLANKOON,
Officer-in-Charge.

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The Tea Research Institute of Ceylon

The Smallholdings Advisory Service

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Office Assistants	...	N. H. H. Liyanage and M. N. J. Deen.
Cinema Operator	...	L. Vincent
Photographer	...	H. W. de Silva

NOTE

The Laboratories of the Institute are situated at St. Coombs Estate, Talawakelle, and letters and enquiries should be addressed to the Director, Tea Research Institute of Ceylon, St. Coombs, Talawakelle, Telegraphic Address:—Research, Talawakelle, Telephone:—Talawakelle 44 (private exchange). Replies to correspondence addressed other than "The Director" may be subject to some delay. Specimens and other consignments sent by rail should be forwarded to Talawakelle station, C/o Messrs. M. Y. Hemachandra & Co., Ltd., Forwarding Agents. Carriage should be prepaid. Letters concerning these specimens, etc., should be sent under separate cover.

The address of the Low-country Scientific Adviser is T.R.I., Pembroke, Bombuwela, near Kalutara, and Low-country estates should address their letters and enquiries directly to this officer.

The address of the Officer-in-Charge of the Smallholdings Advisory Service is 140, Ambagamuwa Road, Gampola.

The Tea Research Institute of Ceylon

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